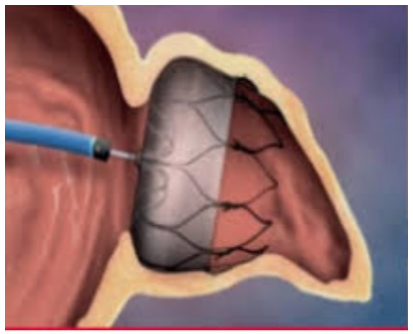
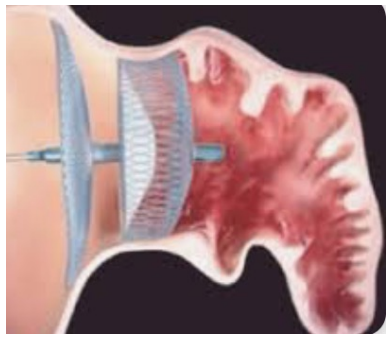
La fermeture de l’auricule en 2023





- INTRODUCTION.
- MATERIEL, IMPLANTATION.
- ETUDES.
- AVENIR.

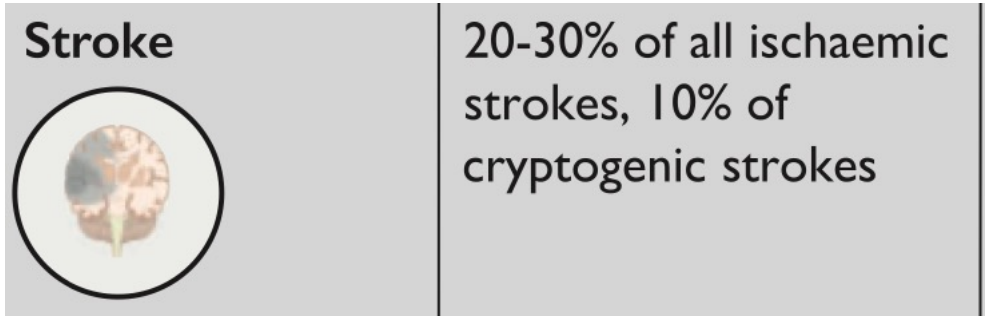
INTRODUCTION

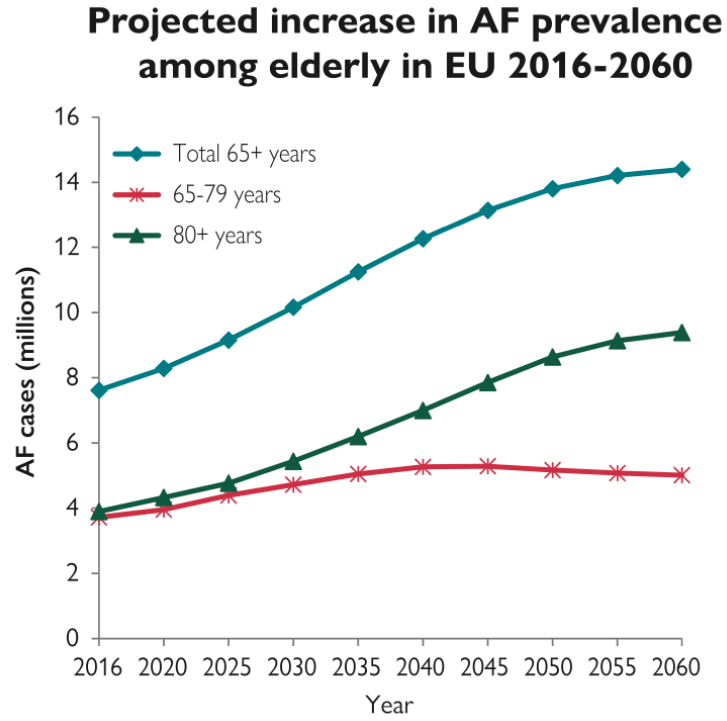
- FA arythmie la plus fréquente
- 1 à 2 % de la population, 1 Million en France

Risque TE X5

- Indication anticoagulant

Quand CHA2DS2vasc ≥ 2





Anticoagulation

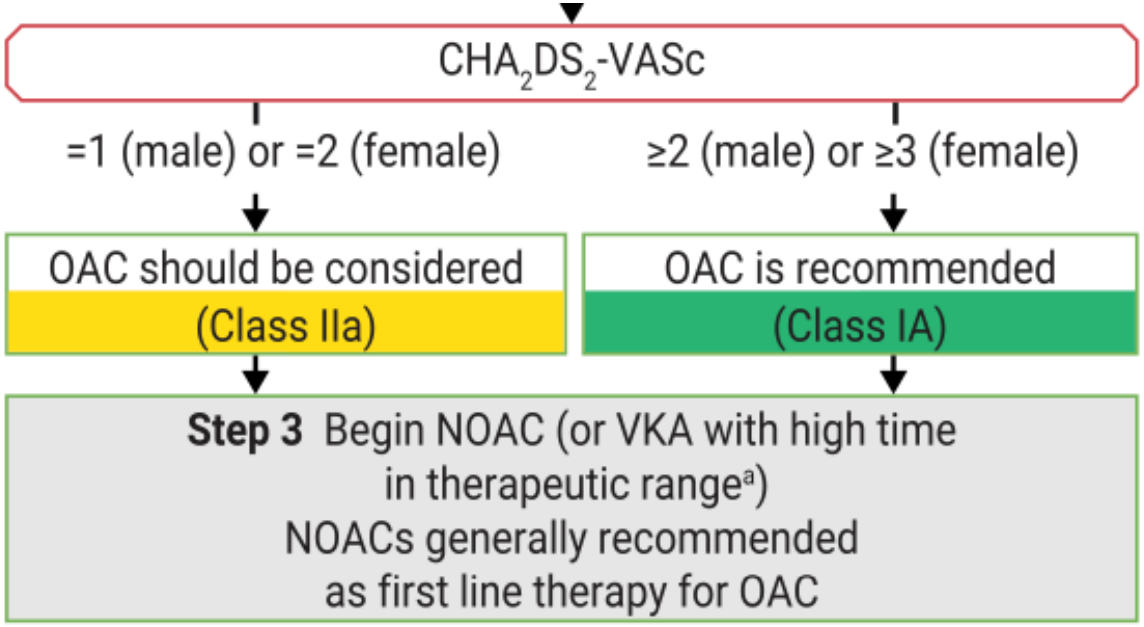
Evaluation du risque d'AVC chez patient en FA

CHA_2DS_2-VASc

CHA_2DS_2-VASc criteria	Score
Congestive heart failure/ left ventricular dysfunction	1
Hypertension	1
Age ≥75 yrs	2
Diabetes mellitus	1
Stroke/transient ischaemic attack/thromboembolism	2
Vascular disease (prior myocardial infarction, peripheral artery disease or aortic plaque)	1
Age 65–74 yrs	1
Sex category (i.e. female gender)	1

Total score	Patients (n=7329)	Adjusted stroke rate (%/year)*
0	1	0.0
1	422	1.3
2	1230	2.2
3	1730	3.2
4	1718	4.0
5	1159	6.7
6	679	9.8
7	294	9.6
8	82	6.7
9	14	15.2

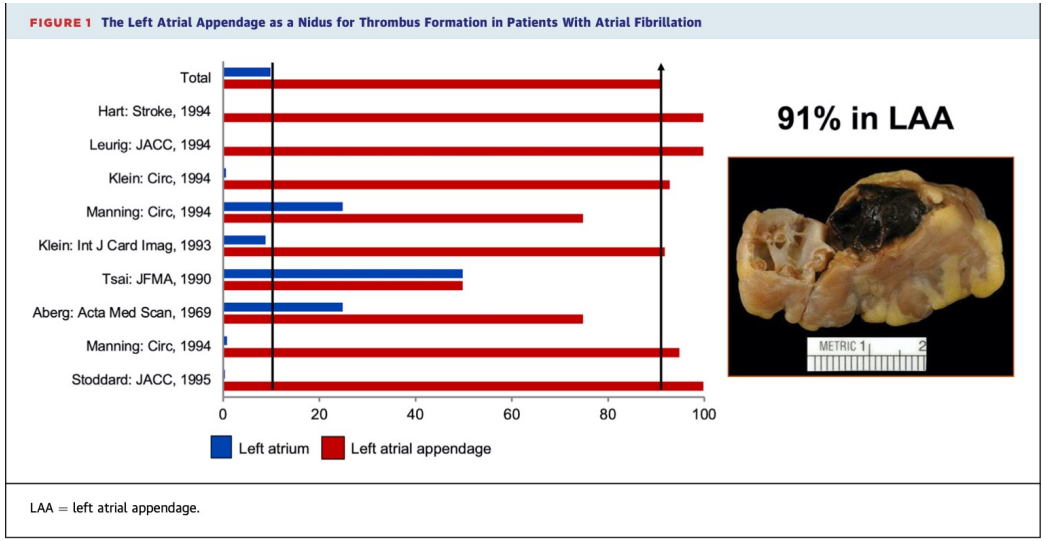
*Theoretical rates without therapy; assuming that warfarin provides a 64% reduction in stroke risk, based on Hart RG et al. 2007



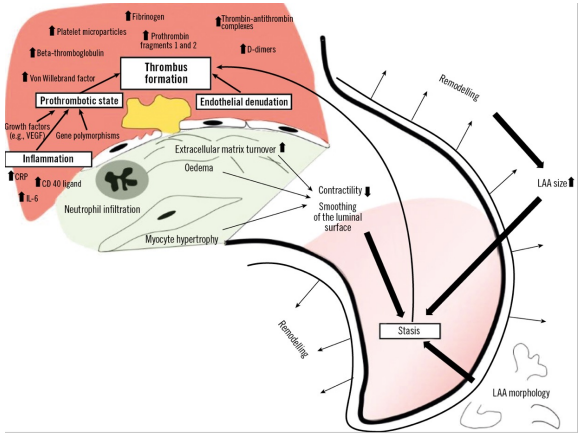
Thrombose

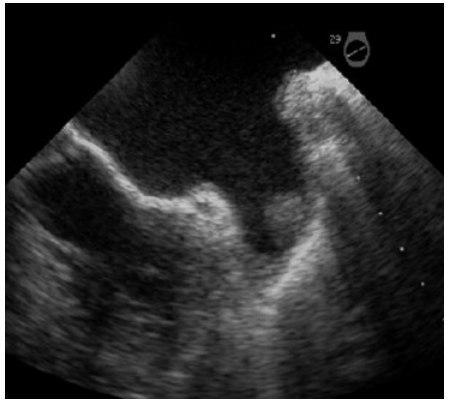
- Thrombus OG : localisé dans 90% des cas dans l'auricule gauche lors de la FA non valvulaire

Etudes échographiques et anatomiques



Hémodynamique stase, anomalie endothélium, coag





- Si l'anticoagulation recommandée, risque saignement

Saignement sous anticoagulant majeurs autour de 3 %/an

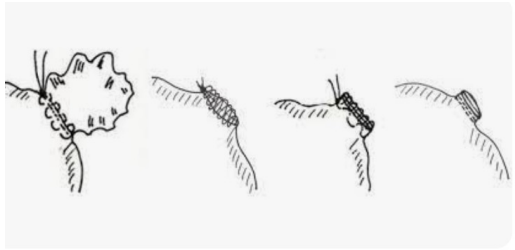
Table 3. Bleeding Outcomes and Net Clinical Outcomes.*

Outcome	Apixaban Group (N=9088)		Warfarin Group (N=9052)		Hazard Ratio (95% CI)	P Value
	Patients with Event	Event Rate	Patients with Event	Event Rate		
	no.	*%/yr*	*no.*	*%/yr*		
Primary safety outcome: ISTH major bleeding†	327	2.13	462	3.09	0.69 (0.60–0.80)	<0.001
Intracranial	52	0.33	122	0.80	0.42 (0.30–0.58)	<0.001
Other location	275	1.79	340	2.27	0.79 (0.68–0.93)	0.004
Gastrointestinal	105	0.76	119	0.86	0.89 (0.70–1.15)	0.37
Major or clinically relevant nonmajor bleeding	613	4.07	877	6.01	0.68 (0.61–0.75)	<0.001
GUSTO severe bleeding	80	0.52	172	1.13	0.46 (0.35–0.60)	<0.001
GUSTO moderate or severe bleeding	199	1.29	328	2.18	0.60 (0.50–0.71)	<0.001
TIMI major bleeding	148	0.96	256	1.69	0.57 (0.46–0.70)	<0.001
TIMI major or minor bleeding	239	1.55	370	2.46	0.63 (0.54–0.75)	<0.001
Any bleeding	2356	18.1	3060	25.8	0.71 (0.68–0.75)	<0.001
Net clinical outcomes						
Stroke, systemic embolism, or major bleeding	521	3.17	666	4.11	0.77 (0.69–0.86)	<0.001
Stroke, systemic embolism, major bleeding, or death from any cause	1009	6.13	1168	7.20	0.85 (0.78–0.92)	<0.001

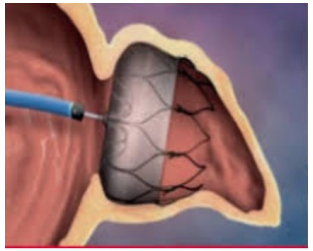
Etude Aristotle 18 201 pts, Apixaban versus Warfarin in Patients with Atrial Fibrillation NEJM 2011

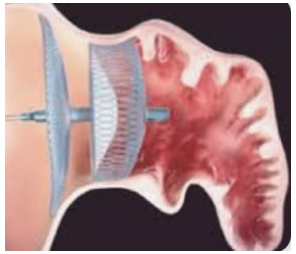
Alternative aux anticoagulants

- Ligature/excision de l’auricule résultats très variables sur oclusion complète.



- Fermeture percutanée par système d’occlusion : Watchman, Amplatzer.

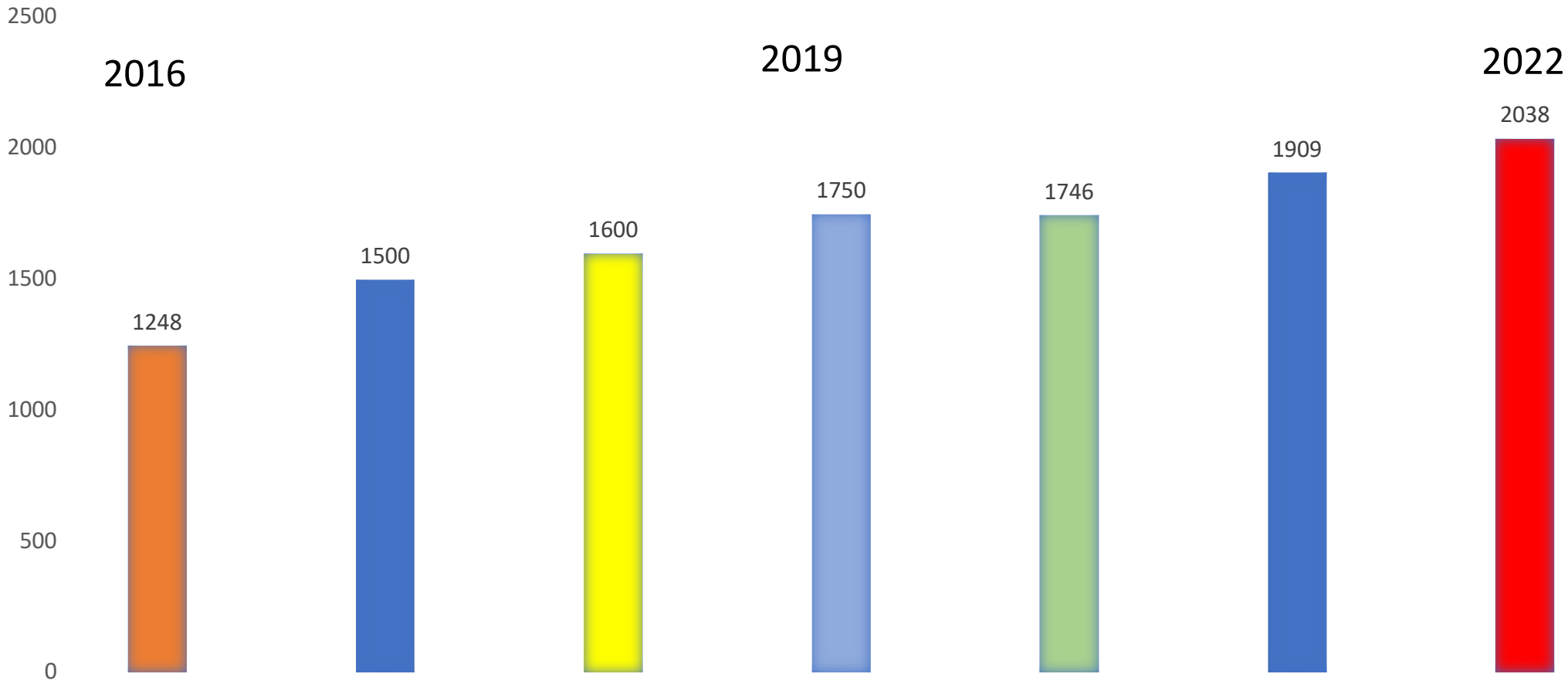




Etat des lieux HAS

- Patients FA, CHADS ≥ 4 25 %
- CI Anticoagulants 10 %
- Population cible FAG 10 000 à 30 000

Implantation en France



Recommandation 2020

Recommendations for occlusion or exclusion of the LAA		
LAA occlusion may be considered for stroke prevention in patients with AF and contraindications for long-term anticoagulant treatment (e.g. intracranial bleeding without a reversible cause).[448,449,481,482]	IIb	B
Surgical occlusion or exclusion of the LAA may be considered for stroke prevention in patients with AF undergoing cardiac surgery.[459,483]	IIb	C

Depuis 2012 !!!
Manque de RCT, RCT avec AOD, Attente
Diminution des complications.

Causes de contre-indication aux AC et FAG

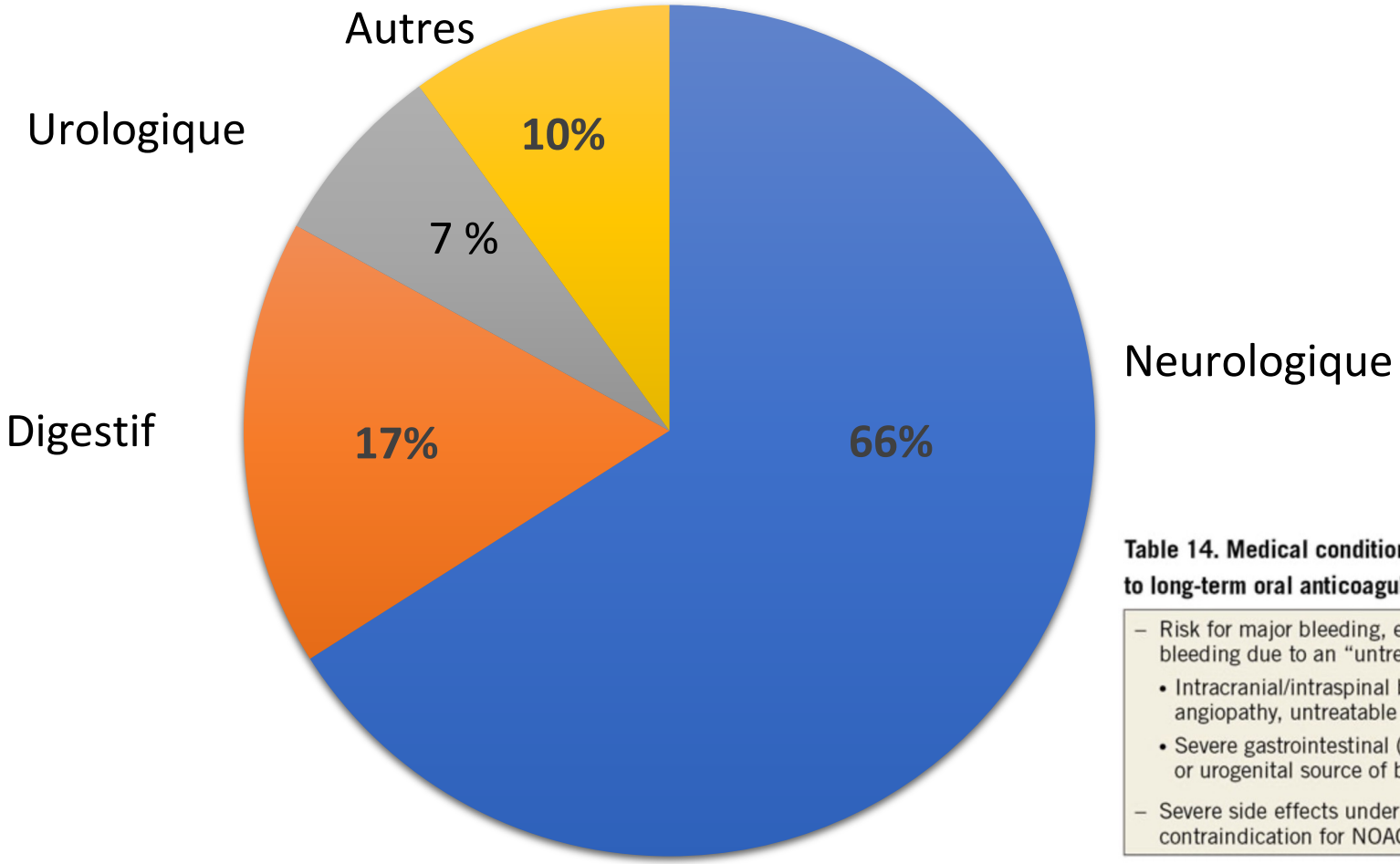
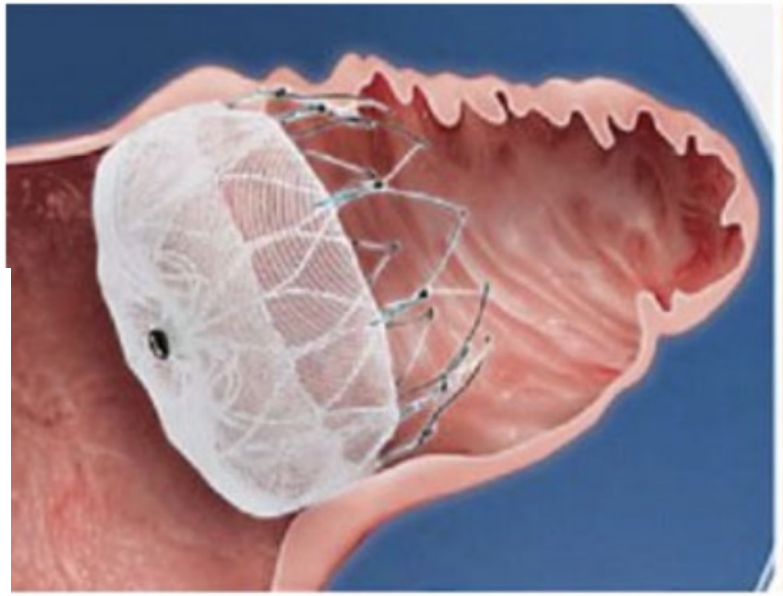


Table 14. Medical conditions which represent contraindications to long-term oral anticoagulation.

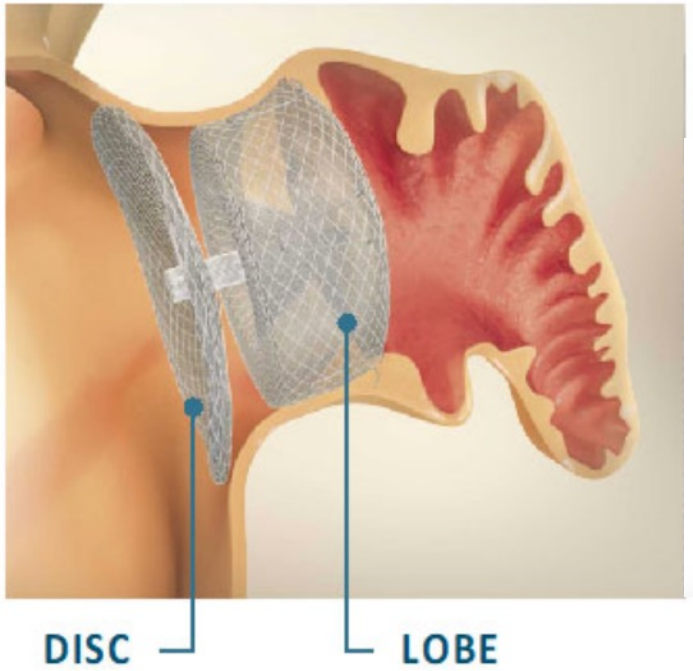
- Risk for major bleeding, especially life-threatening or disabling bleeding due to an "untreatable" source of
  - Intracranial/intraspinal bleeding (e.g., diffuse amyloid angiopathy, untreatable vascular malformation)
  - Severe gastrointestinal (e.g., diffuse angiodysplasia) pulmonary or urogenital source of bleeding that cannot be corrected
- Severe side effects under vitamin K antagonists and/or contraindication for NOAC

2 dispositifs principaux

Watchman device



Amplatzer Amulet LAA Occluder

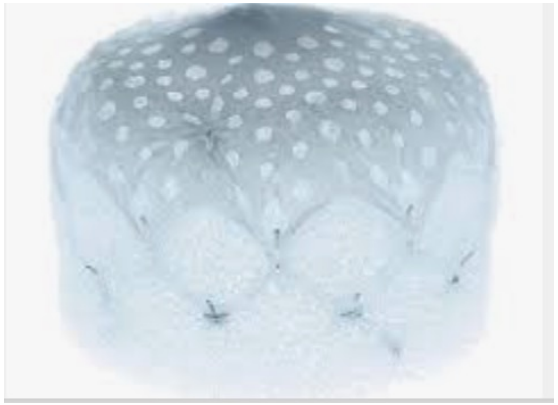


4489,5 E.

Auto extensible avec structure à base de Nitinol

Evolution matériel: plus de tailles, d'attaches, réduction fuites.

Lambre,
Lifetech CE
4417 euros 2020

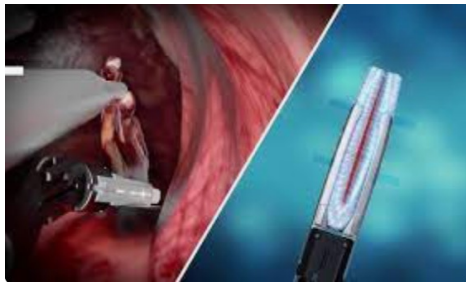


CLAAS, conformal medical
étude en cours

WaveCrest,
Biosense,CE

Ultraseal
Cardia CE

Et encore d’autres en développement !



INDICATION – Environnement, en France

CODE	TEXTE	ACTIVITÉ	PHASE	REMBT. SS conditions	ACCORD préalable
DASF074	**Fermeture de l'appendice atrial [auricule] gauche par voie veineuse transcutanée et voie transseptale par guidage échographie-doppler par voie transœsophagienne** *Avec ou sans : injection de produit de contraste* *Indication :* *– prévention des événements thromboemboliques chez les patients en fibrillation auriculaire non valvulaire à haut risque thromboembolique avec un score $CHAD_2DS_2$-VASC ≥4 et une contre-indication formelle et permanente aux anticoagulants validée en concertation pluridisciplinaire.* *– le refus des traitements anticoagulants oraux ne constitue pas une indication.* *Avis HAS du 9 juillet 2014* *Contre-indication :* *– enfants* *– thrombus intracardiaque* *Formation : selon avis de la HAS du 9 juillet 2014* *Environnement : selon avis de la HAS du 9 juillet 2014* *Recueil prospectif de données : sous forme d'un registre* *Facturation : prise en charge sous réserve de remplir l'ensemble des conditions suivantes :* *– établissement de santé titulaire d'une autorisation d'activité de chirurgie cardiaque et d'une autorisation d'activité interventionnelle sous imagerie médicale par voie endovasculaire en cardiologie et répondant aux critères définis par arrêté ministériel* *– présence obligatoire pendant la durée de l'intervention de :*				

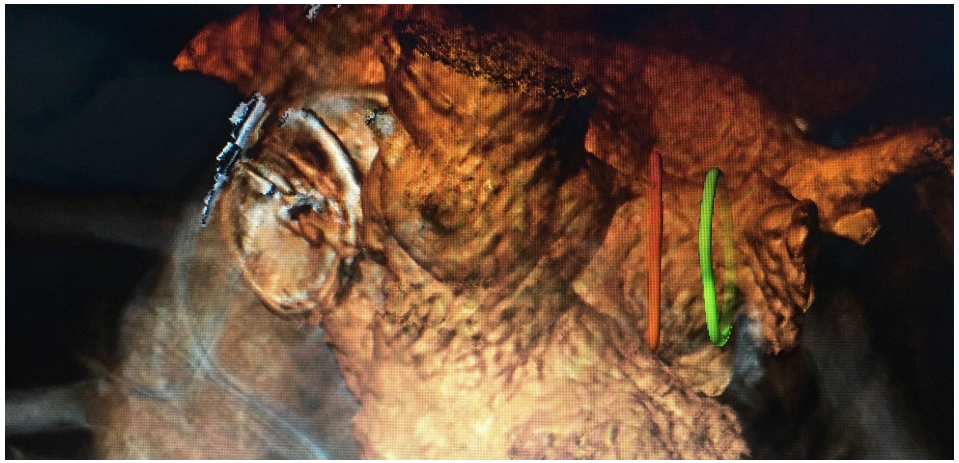
CODE	TEXTE	ACTIVITÉ	PHASE	REMBT. SS conditions	ACCORD préalable
	– deux opérateurs qualifiés, hors médecin anesthésiste, dont au moins un cardiologue formé à la ponction transseptale *– un cardiologue échographiste* *– disponibilité pendant la durée de l'intervention d'un chirurgien cardiovasculaire et thoracique.* *Le tarif prend en compte la mesure des pressions cardio-vasculaires et les angiographies, l'éventuelle pose de sonde d'entraînement électrosystolique.*				

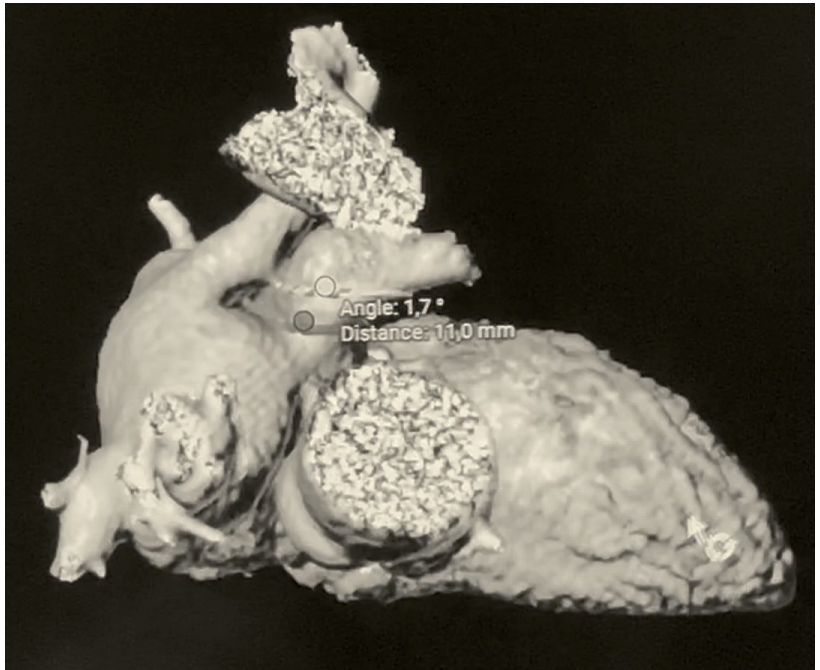
Remboursement 2016
CHAD2DS2-Vasc ≥ 4
CI anticoagulant
CI FAG: thrombus auricule

Cardiologue interventionnel habitué à la ponction transeptale.
Cardiologue échographiste

Chirurgie cardiaque sur place.
Cible > 25 /opérateur 50/centre

IMPLANTATION: Sizing





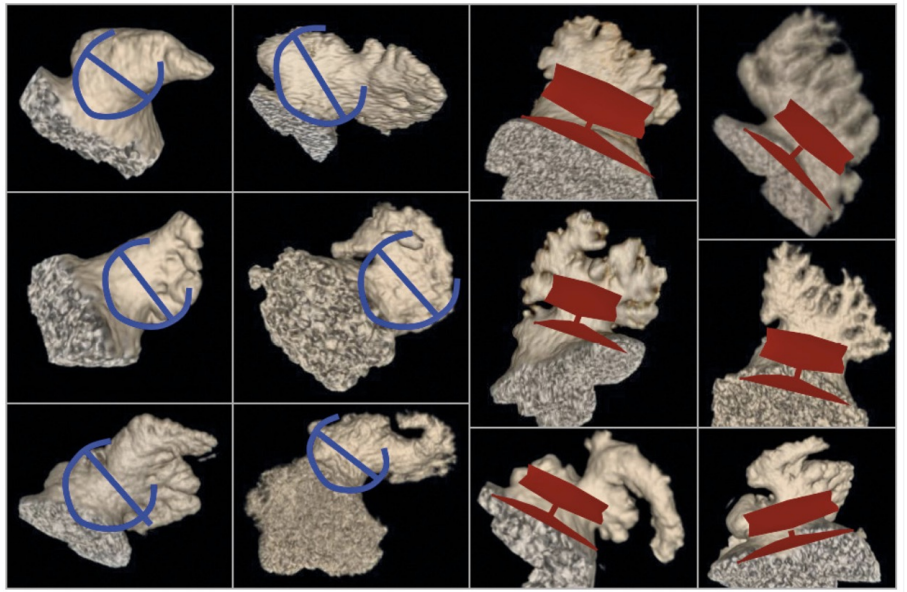
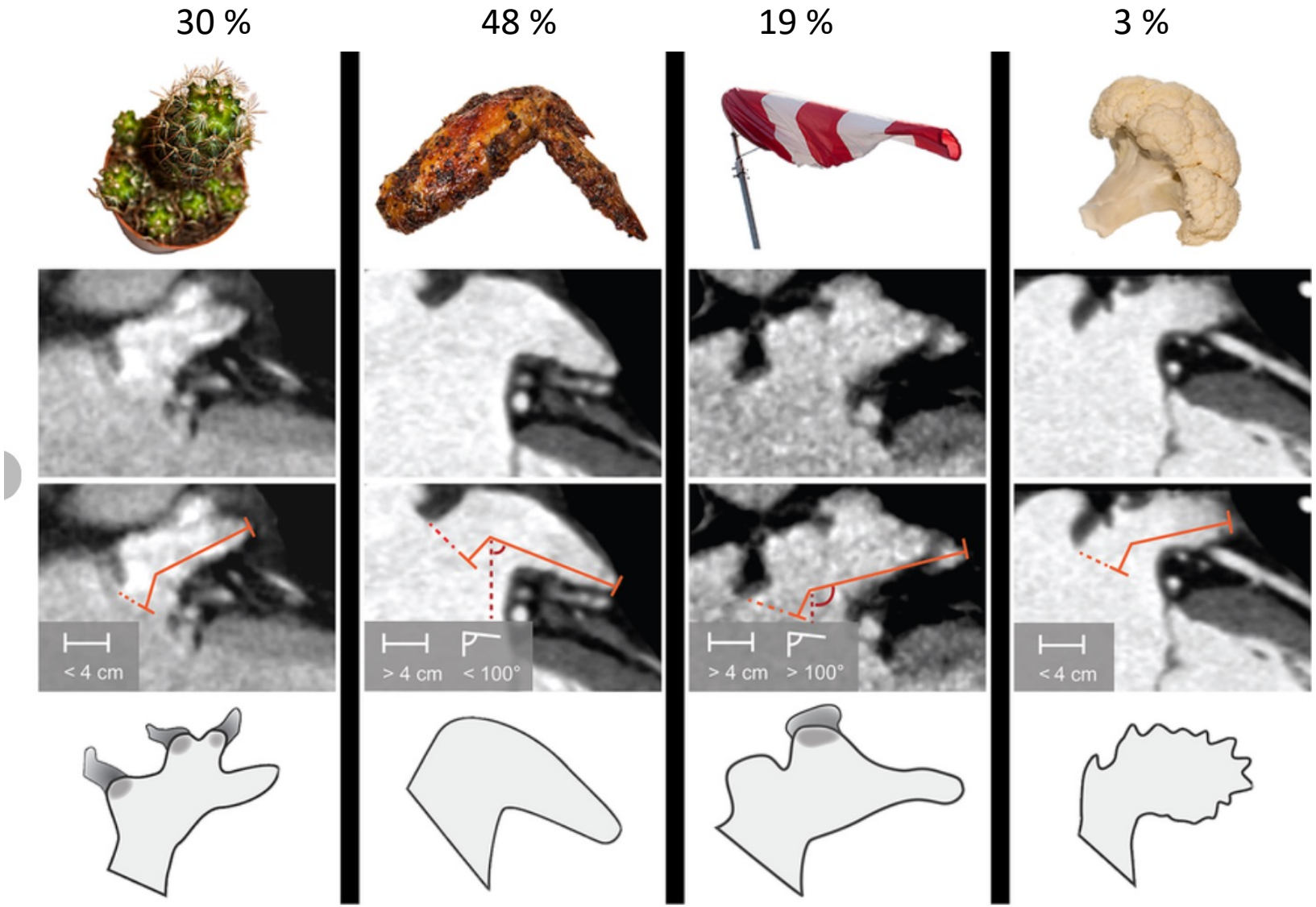


Figure 4. 3D volume-rendered CCTA images showing examples of LAA shapes and envisioning of implant locations with WATCHMAN (blue schematic) and Amulet (red schematic) implants.

Largeur maximale de la zone de pose (mm)	Taille du dispositif (mm)	Longueur du lobe (mm)	Profondeur min. de l'auricule gauche (mm)	Diamètre du disque (mm)	Diamètre de la gaine
11,0 – 13,0	**16**	7,5	≥10	22	12 F ou 14 F (avec adaptateur)
13,0 – 15,0	**18**	7,5	≥10	24	
15,0 – 17,0	**20**	7,5	≥10	26	
17,0 – 19,0	**22**	7,5	≥10	28	
19,0 – 22,0	**25**	10	≥12	32	
22,0 – 25,0	**28**	10	≥12	35	14 F
25,0 – 28,0	**31**	10	≥12	38	
28,0 – 31,0	**34**	10	≥12	41	

Anatomie



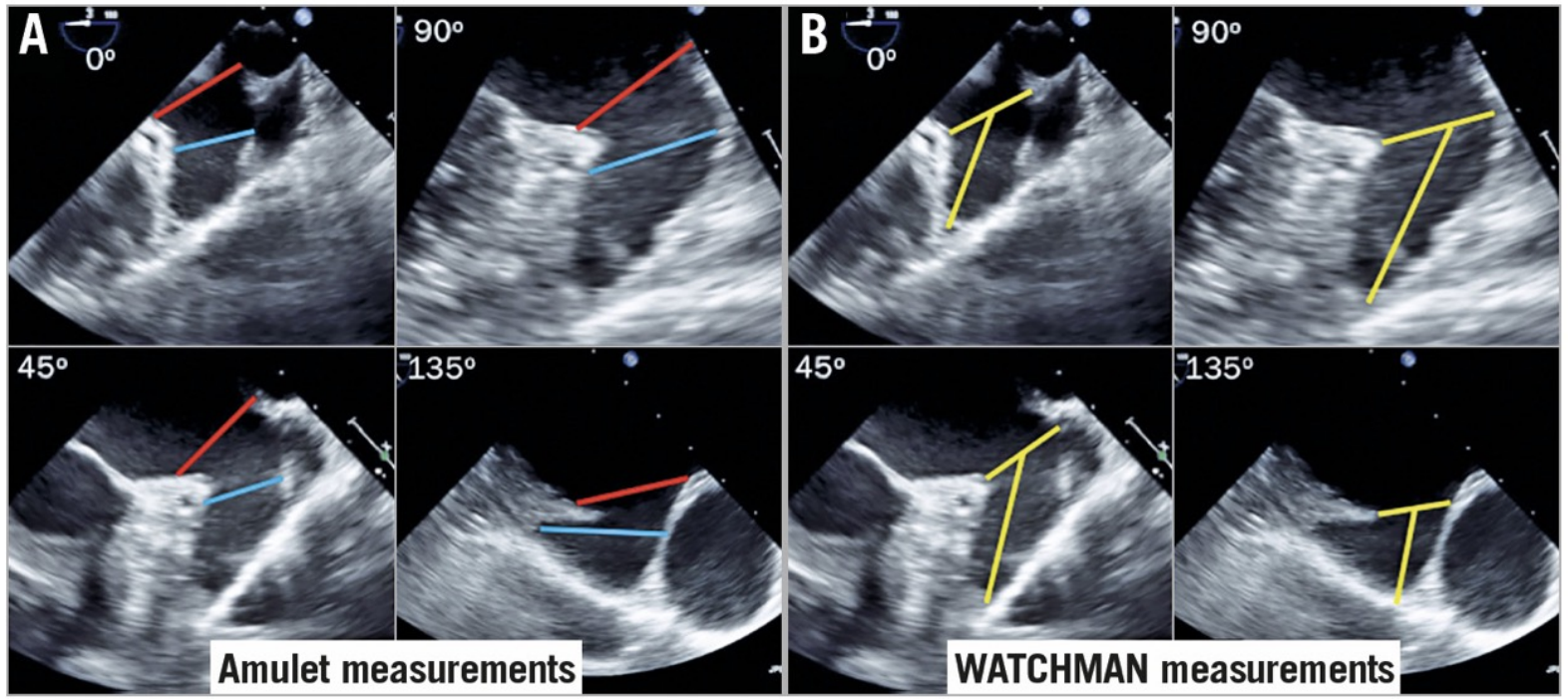
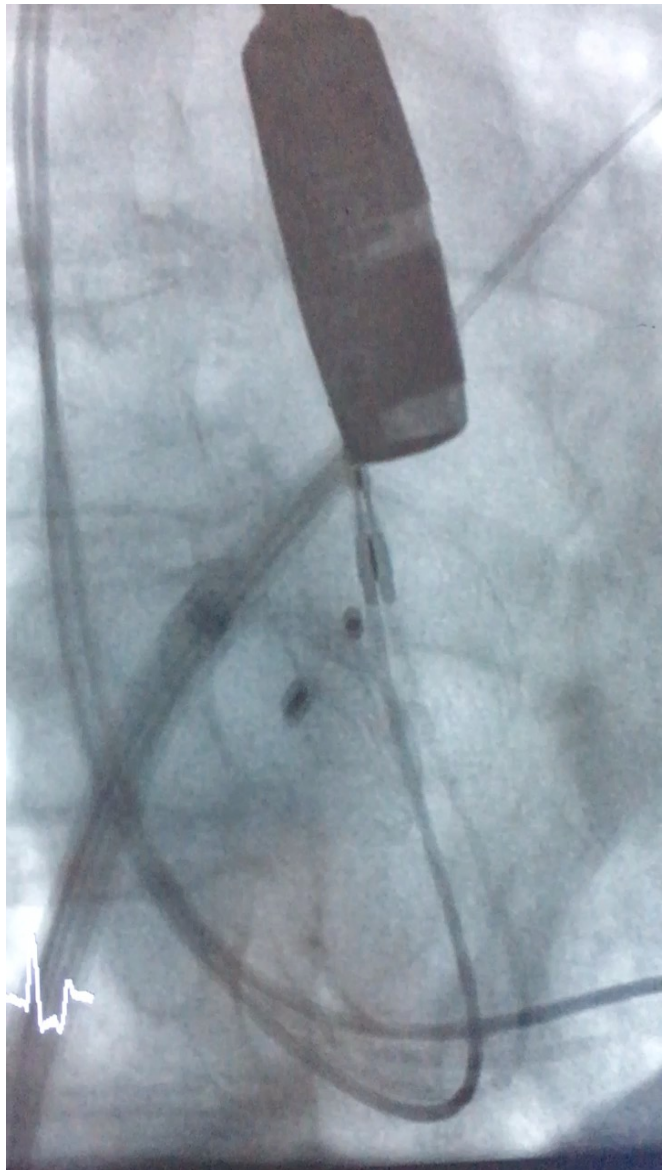
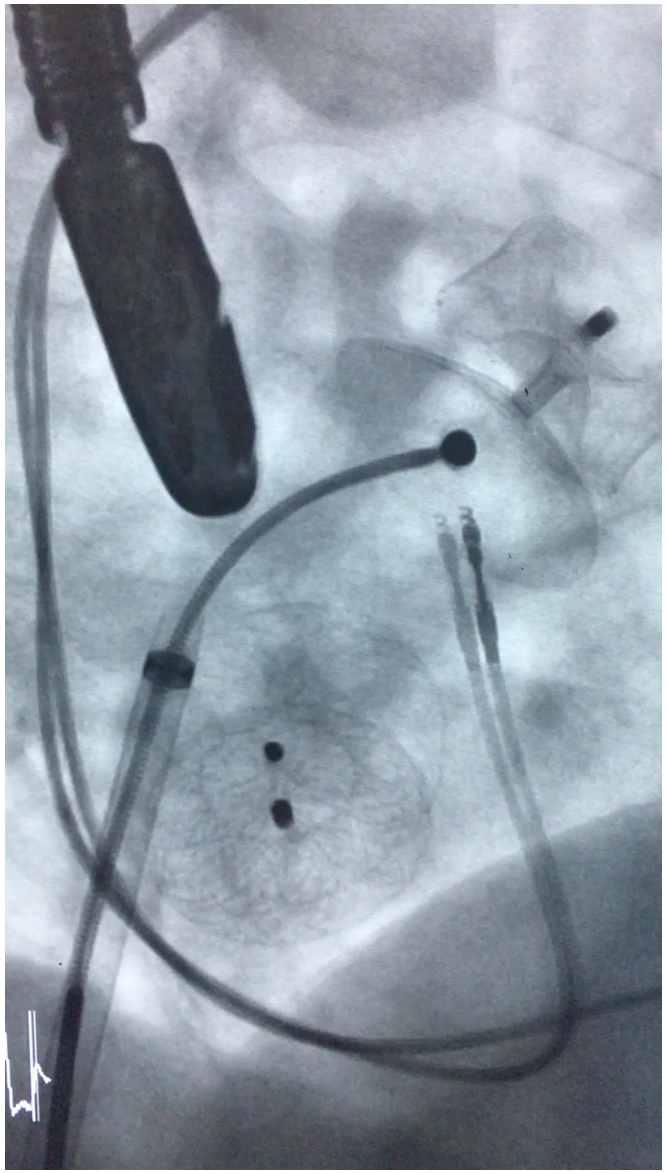


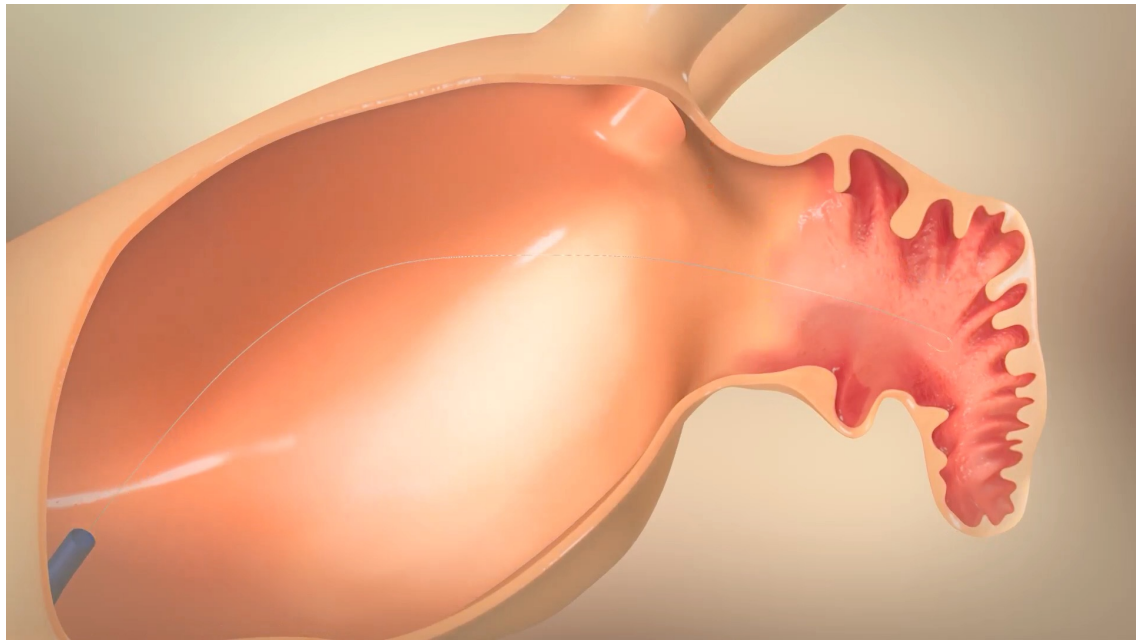
Figure 8. TOE measurements for the Amulet and WATCHMAN devices. A) TOE measurements at four angles for the Amulet device at the echocardiographic orifice (red lines) and at the landing zone 12 mm inside the orifice (blue lines). B) TOE measurements at four angles for the WATCHMAN device for the orifice diameter and depth.

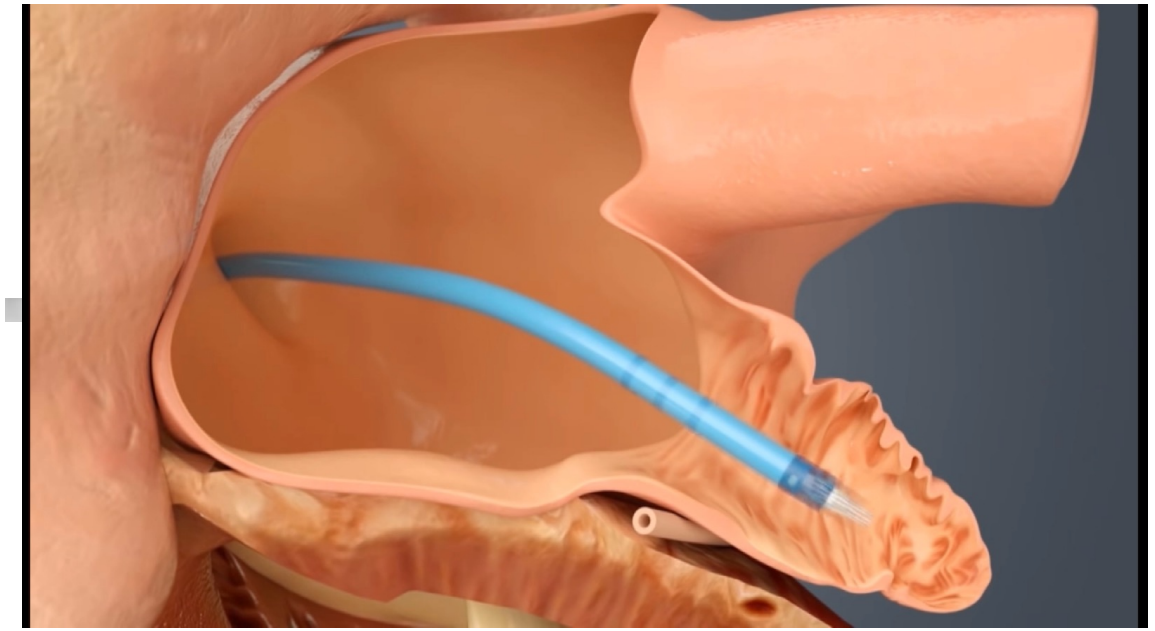


IMPLANTATION

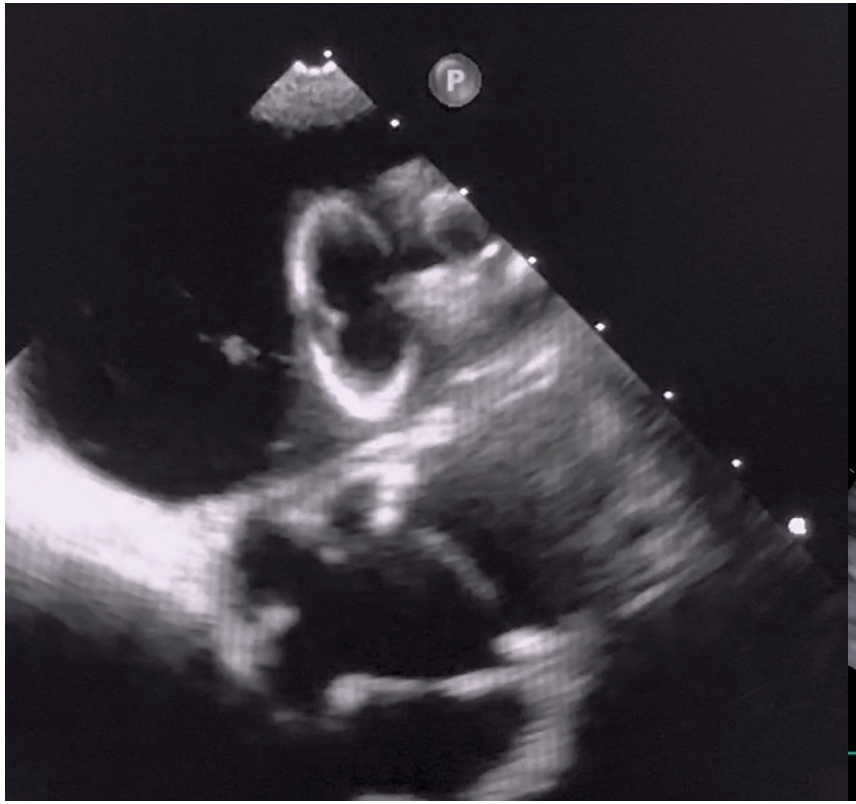
AG, < 1h,
Transseptal.
ACT 250-300 sec
Largage si compression, stabilité (Tug test), étanchéité (pas de fuite)

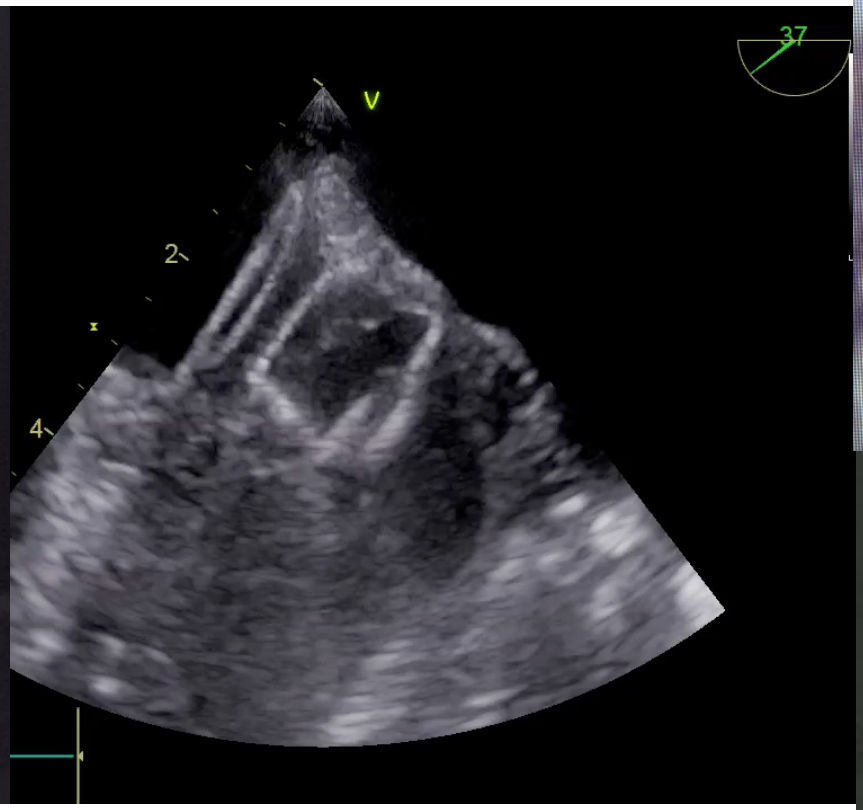


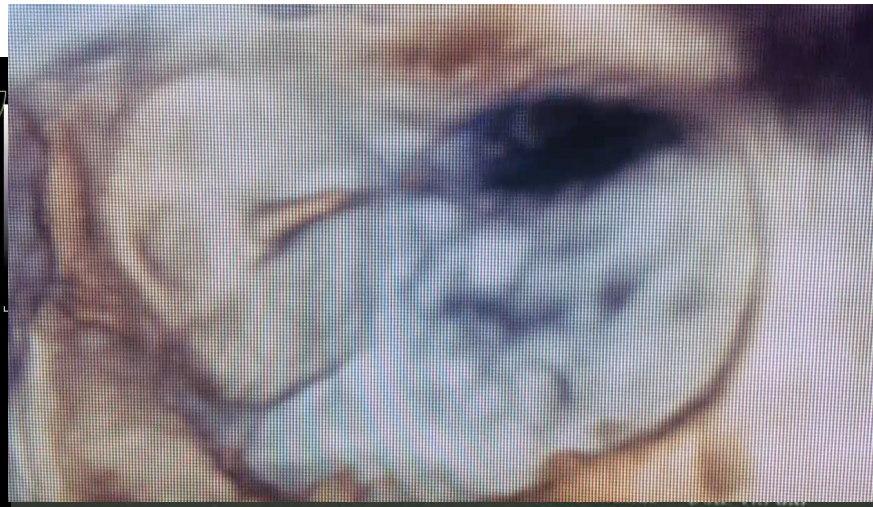


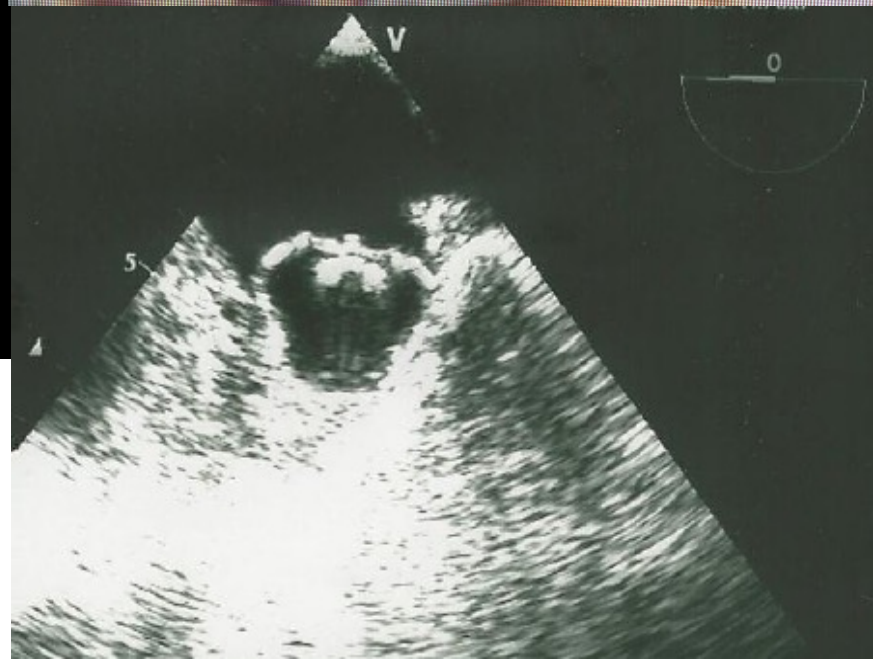


ETO









Procédure

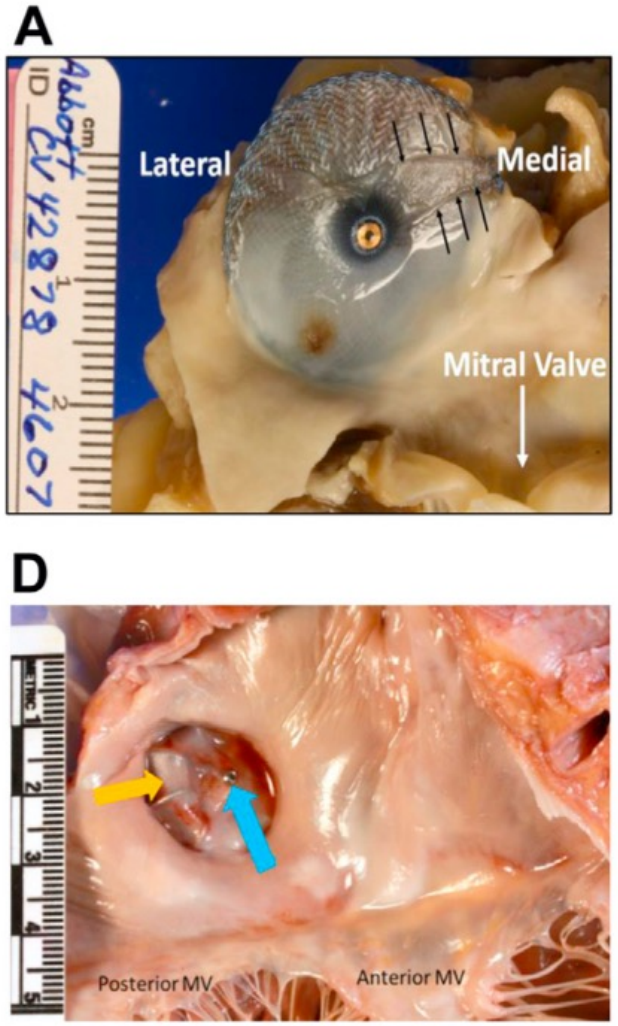
- AG, < 1 H
- Succès implantation autour de 98 %.
- Contrôle ETT et sortie J1.
- Complication < 2 % quand équipe entrainée.

TABLE 4 **Procedural and Late Postprocedural Complications of Left Atrial Appendage Occlusion**

Periprocedural Complications	Postprocedural Complications
Death (<0.2%)	Late pericardial effusion & tamponade (~1%)
Stroke (<0.2%):	Peridevice leak:
Ischemic: air or thromboembolism Hemorrhagic	>5 mm on TEE: 1%-3% >3 mm on TEE: 10%-25%
Systemic embolism (rare)	Device-related thrombus (3%-5%)
Pericardial tamponade (~1%)	Late device migration/embolization (infrequent)
Device embolization (~0.2%)	Device erosion (rare)
Vascular complications: retroperitoneal bleed, arteriovenous fistula, pseudoaneurysm	Iatrogenic atrial septal defects (rare to require intervention)
Other: major bleeding, renal failure, respiratory failure, sepsis, MI, endotracheal/esophageal damage, interfering surrounding structures, device/contrast allergy, pericarditis	

SCAI/HRS Expert Consensus Statement on Transcatheter Left Atrial Appendage Closure
JACC, 2023

Endothelialisation prothèse A et W



Pas vraiment connue chez l'homme empiriquement 4 à 6 semaines.

AAP AC

Table 12 **Antithrombotic therapy after left atrial appendage occlusion**

Device/patient	Aspirin	OAC	Clopidogrel	Comments
Watchman/low bleeding risk	75 - 325 mg/day indefinitely	Start warfarin after procedure (target INR 2 - 3) until 45 days or continue until adequate LAA sealing is confirmed[a] by TOE. NOAC is a possible alternative	Start 75 mg/day when OAC stopped, continue until 6 months after the procedure	Some centres do not withhold OAC at the time of procedure (no data to support/deny this approach)
Watchman/high bleeding risk	75 - 325 mg/day indefinitely	None	75 mg/day for 1 - 6 months while ensuring adequate LAA sealing[a]	Clopidogrel often given for shorter time in very high-risk situations
ACP/Amulet	75 - 325 mg/day indefinitely	None	75 mg/day for 1 - 6 months while ensuring adequate LAA sealing[a]	Clopidogrel may replace long-term aspirin if better tolerated

Pas d'études randomisées
Real world DAPT 1 à 3 mois
Real real word Aspirine

Safety and Efficacy of Single Versus Dual Antiplatelet Therapy After Left Atrial Appendage Occlusion

American Journal Of Cardiology 2020

Etude observationnelle à 1 an, rétrospective, multicentrique, analyse multivariée et score de propension.
Critère primaire: saignement, complication cardio-vasculaire grave, Thrombose prothèse.

SAPT vs DAPT
Moins de saignement
Pas plus de thrombose

Nécessite RCT

	SAPT n=280	DAPT n=330	P
Age	76	74,9	NS
CHAD2DS2Vasc	4,28	3,94	0,004
HAS BLED	3,42	3,25	NS
CP	9,3 %	12,7 %	NS
Saignement	2,9 %	6,7 %	0,038
AVC DRT	7,8 %	7,4 %	NS

Table 18 (part 1). Antithrombotic therapy before and after LAAO.

Clinical situation and therapeutic concept	Consensus statement	Symbol	References
Acetylsalicylic acid 75-325 mg/day for the procedure and then continued long term (load 300-500 mg prior to procedure if not previously on acetylsalicylic acid)	"Should do this"		108,114, 100,170
Anticoagulation, using unfractionated heparin, is recommended during the implantation procedure prior to or immediately after TSP, aiming for an activated clotting time of >250 s	"Should do this"		106,111
After WATCHMAN implantation, warfarin (INR 2-3) should be given for 45 days, followed by clopidogrel for 6 months after the procedure in low bleeding risk group of patients, while in high bleeding risk group OAC should not be applied	"Should do this"		106,108
NOAC is a possible alternative to warfarin after WATCHMAN implantation	"May do this"		155,163-165
After WATCHMAN implantation in patients not suitable for oral anticoagulation, DAPT including clopidogrel 75 mg/day for 1 to 6 months after the procedure (load 300-600 mg prior to procedure if not previously on clopidogrel)	"May do this"		106,108,171
After AMPLATZER Cardiac Plug or Amulet implantation, DAPT including clopidogrel 75 mg/day for 1 to 6 months after the procedure (load 300-600 mg prior to procedure if not previously on clopidogrel)	"May do this"		115,170
Other options that may be considered on a case-by-case basis include a single antiplatelet therapy (acetylsalicylic acid or clopidogrel) for short periods of time, as long as approved by a team consensus	"May do this"		172

EHRA 2020

Reduced Rivaroxaban Dose Versus Dual Antiplatelet Therapy After Left Atrial Appendage Closure

ADRIFT a Randomized Pilot Study

Clinical Cardiovasc Interv 2020

Table 4. Clinical Outcomes at 3 Months

Clinical End Points at 90 Days	Rivaroxaban 10 mg (n=37)	Rivaroxaban 15 mg (n=34)	DAPT (n=33)	*P* Value
Death*	0 (0.00%)	1 (2.94%)	0 (0.00%)	0.33
Myocardial infarction	1 (2.70%)	0 (0.00%)	0 (0.00%)	0.68
Stroke†	1 (2.70%)	0 (0.00%)	0 (0.00%)	0.68
Systemic embolism	0 (0.00%)	0 (0.00%)	0 (0.00%)	…
Extracranial bleeding (ISTH)				
Major	8 (21.62%)	2 (5.88%)	7 (21.21%)	0.97
Non major, clinically significant	1 (2.70%)	2 (5.88%)	2 (6.06%)	0.62
Non major, not clinically significant	4 (10.81%)	8 (23.53%)	6 (18.18%)	0.34
Major or clinically significant	9 (24.32%)	4 (11.43%)	9 (27.27%)	0.96
Extracranial bleeding (TIMI)				
Major	2 (5.41%)	0 (0.00%)	1 (3.03%)	0.86
Minor	7 (18.92%)	4 (11.76%)	7 (21.21%)	0.88
Minimal	4 (10.81%)	8 (22.86%)	7 (21.21%)	0.46
Net clinical benefit: death, stroke, myocardial infarction, systemic embolism, major or clinically significant ISTH bleeding	9 (24.32%)	5 (14.71%)	9 (27.27%)	0.92

Pas de différence petite dose Xarelto vs DAPT à 3 mois

Petite étude à confirmer

Etudes randomisées en cours

Table 3. Ongoing Studies on Antithrombotic Treatment After Percutaneous LAAC

Name	Device	No. of patients	Design and antithrombotic regimen	Primary end points	Estimated completion date
ASPIRIN-LAAO (NCT3821883)	Any device	1120	Double-blind randomized trial at 6 mo after LAAC: long-term aspirin, discontinuation of aspirin	At 24 mo: stroke, systematic embolism, major bleeding, cardiovascular death	End of 2024
ANDES (NCT03568890)	Any device	350	Open-label randomized between: DAPT for 8 wk, DOAC for 8 wk	Device-related thrombosis at 8 wk after LAAC	End of 2022
APPENDAGE (NCT04796714)	Any device	60	Open-label randomized between: DAPT for 3 mo, SAPT with aspirin (160 mg) for 3 mo	Apparition of new ischemic lesions at 3 mo on cerebral magnetic resonances	November 2022
FADE-DRT (NCT04502017)	WATCH-MAN FLX	360	Open-labeled randomized between 3 arms: OAC for 6 wk then DAPT until 6 mo, OAC for 6 wk, then DAPT or half-dose OAC in clopidogrel nonresponder, half-dose DOAC	At 1-y efficacy: composite of stroke, systemic embolism, and device-related thrombosis, safety, major bleedings	December 2023

Aspirine vs rien, DAPT vs OAD, DAPT vs SAPT,

Contrôle post implantation

Post-procedural imaging should be performed at 6-24 weeks post implantation to assess for DRT	"Should do this"	
Post-procedural imaging may be repeated after 12 months post implantation to assess for DRT	"May do this"	
Presence of DRT on the atrial side of the device should be treated with intensified anticoagulation to resolve thrombus	"Should do this"	

ETO
Ou
SCANNER

Recherche thrombus, fuite.

EHRA 2020

LES ETUDES

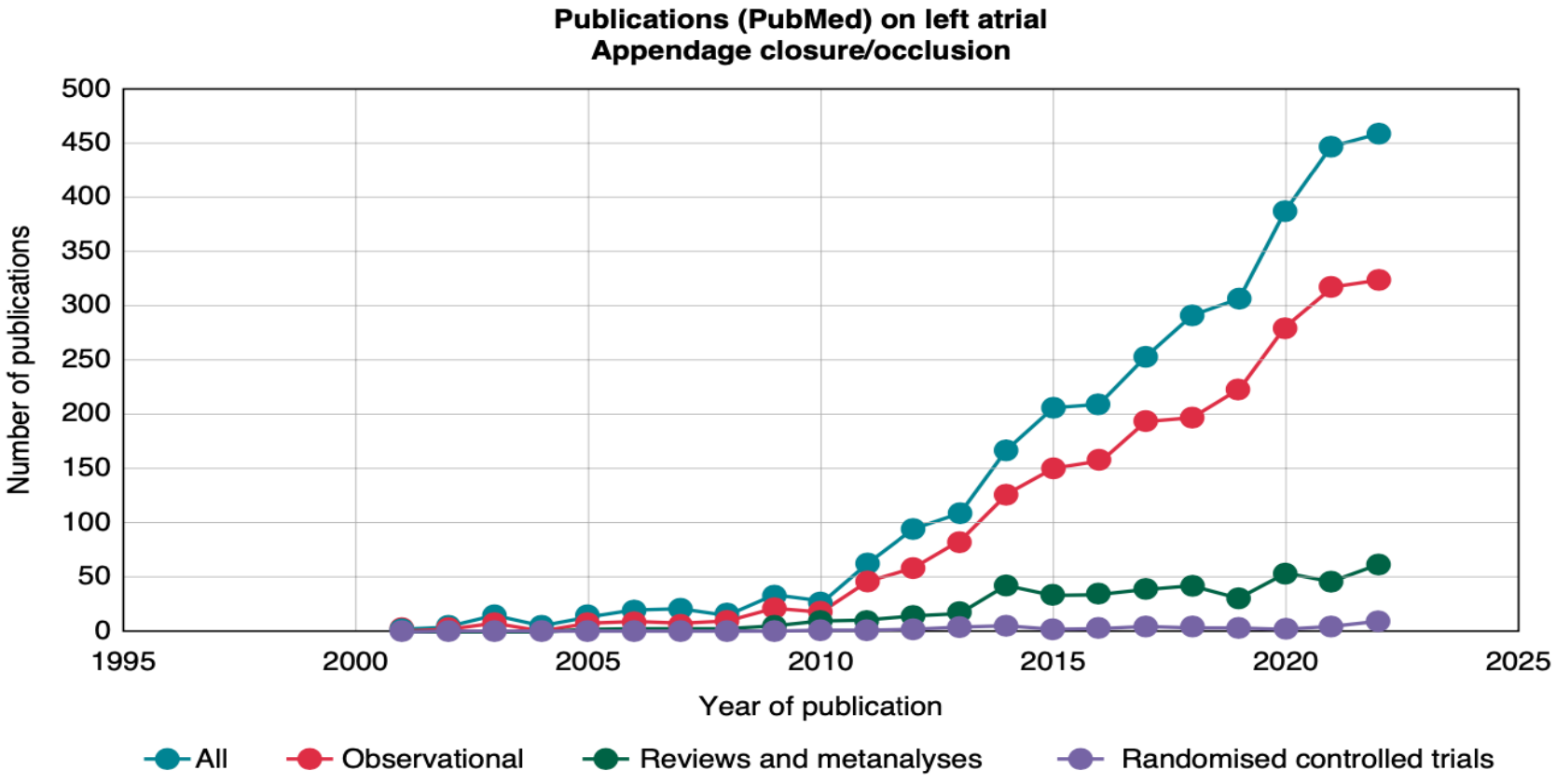


Figure 1 Search on PubMed for publications relating to 'left atrial appendage closure OR left atrial appendage occlusion' from 2001 to 2022. Reviews and metanalyses and RCT (randomized controlled trial) data are obtained using the appropriate NCBI filters and the observational data are derived by adding 'AND observational OR registry' to the search terms.

5-Year Outcomes After Left Atrial Appendage Closure: From the PREVAIL and PROTECT AF Trial Jacc 2017

	Device Group (n = 732)		Control Group (n = 382)		Hazard Ratio (95% Confidence Interval)	p Value
	No. of Events	Rate (per 100 PY)	No. of Events	Rate (per 100 PY)		
Efficacy: stroke/SE/CV death	79/2,856.0	2.8%	50/1,472.8	3.4%	0.82 (0.58–1.17)	0.27
All stroke or SE	49/2,849.4	1.7%	27/1,472.9	1.8%	0.96 (0.60–1.54)	0.87
Ischemic stroke or SE	45/2,850.2	1.6%	14/1,479.1	0.95%	1.71 (0.94–3.11)	0.08
Hemorrhagic stroke	5/2,954.8	0.17%	13/1,499.0	0.87%	0.20 (0.07–0.56)	0.0022
Ischemic stroke or SE >7 days	37/2,862.1	1.3%	14/1,479.1	0.95%	1.40 (0.76–2.59)	0.28
Disabling stroke	13/2,943.0	0.44%	15/1,493.8	1.0%	0.45 (0.21–0.94)	0.03
Nondisabling stroke	31/2,879.1	1.1%	12/1,484.3	0.81%	1.38 (0.71–2.68)	0.35
CV/unexplained death	39/2,960.5	1.3%	33/1,505.2	2.2%	0.59 (0.37–0.94)	0.027
All-cause death	106/2,961.6	3.6%	73/1,505.2	4.9%	0.73 (0.54–0.98)	0.035

Efficacité

RCT : W Vs AC, 1114 pts Non infériorité.
Age M 72- 74 ans
CHADS2VASC M 3,5-4
Efficacité comparable (AVC, SE, DC)
Réduction des saignement majeurs
Réduction DC.

Table 9. WATCHMAN studies.

Study details			Patient details				Efficacy				Safety				
First author and dates of publication	RCT or registry	Number of patients with device	Mean age	Mean $CHADS_2$/ CHADS-VASc score	% ineligible for OAC	Mean FU (months)	Implant success	Major leak	All stroke	Ischaemic stroke/SE	SAE in first 7 days	Effusion+	Embolisation	Procedure-related stroke	Procedure-related death
Holmes 2009[106] Reddy 2014[107]	MRCT	463	71.7±8.8	2.2±1.2/3.4	0	18±10 45±20	88.0%	8% at 6-month TOE	2.3/100 patient years 1.5/100 patient years	2.5/100 patient years 1.6/100 patient years	7.7%	4.1%	0.6%	0.9%	0
Holmes 2014[108]	MRCT	269	74±4	2.6±1.0/ 3.8±1.2	0	11.8±5.8	95.1%		2.3% patients during FU	2.3% patients during FU	4.2%	1.9%	0.7%	0.4%	0
Reddy 2017[6]	Meta-analysis of 2 RCTs	732	72.6±8.4	2.3±1.1/ 3.6±1.4	0	4,343 patient years	95.4%		1.77 per 100 patient years	1.6 per 100 patient years					
Reddy 2011[98]	MReg	460	74±8	2.2±1.2	0		95.0%				3.7%	2.2%	0	0	0
Reddy 2013[109]	MReg	150	72.5±7.4	2.8±1.2/ 4.4±1.7	100%	14.4±8.6	95.0%		2.3 per 100 patient years	1.7 per 100 patient years		1.3%	1.3%	0	0
Boersma 2016[112], 2017[95]	MReg	1,021	73±9	2.8±1.3/ 4.5±1.6	62%	12 months	98.5%	0.7%	Ischaemic stroke 1.1% per year	Ischaemic stroke/TIA/ SE=1.5% per year	2.8%	0.4%	0.2%	0.1%	0.1%
Reddy 2017[113]	MReg	3,822					95.6%					1%	0.24	0.08%	0.08%

+needing intervention (drainage or surgery). FU: follow-up; MReg: multicentre registry; (M)RCT: (multicentre) randomised controlled trial

Table 10. AMPLATZER studies.

Study details				Patient details				Efficacy				Safety				
First author and dates of publication	RCT or registry	Device	Number of patients with device	Mean age	Mean $CHADS_2$/ CHADS-VASc score	% ineligible for OAC	Mean FU (months)	Implant success	Major leak	All stroke	Ischaemic stroke / SE / TIA	SAE in first 7 days	Effusion+	Embolisation	Procedure-related stroke	Procedure-related death
Nietlispach 2013[72]	SReg	ACP+ Nded Dev.	152	72±10	3.4±1.7	76%	32 (up to 120)	96.1% 99.2% in ACP group	0.7%	0.5%/year		7.2% overall, 3.3% in ACP	2.6%	3.9%; 0.8% in ACP group	0.7%	0.0%
Tzikas 2016[114]	MReg	ACP	1,047	7±8	2.8±1.3/ 4.5±1.6	73%	13	97.3%	1.9%		Stroke or TIA 2.3% per year	5%	0.5%	0.8%	0.9%	0.8%
Lopez-Minguez 2015[115]	MReg	ACP	167	74.7±8.6	3/4	100%	22±8.3	94.6%	8.2%	–	Stroke or TIA 2.4% per year	5.4%	1.2%	0.6%	0	0
Urena 2013[129]	MReg	ACP	52	74±8	3/–	100%	20±5	98.1%	0	1 ischaemic stroke and 1 TIA during FU		5.8%	1.9%	1.9%	0	0
Berti 2017[118]	MReg	ACP+Am	613	75.1±8.0	–/4.2±1.5	84.5%	20	95.4%	0.5%	1.8 per 100 patient years	Stroke or TIA 2.45% per year	6.2%		0.7%		0
Landmesser 2017[97] and 2018[116]	MReg	Am	1,088	75±8.5	–/4.2±1.6	83%	12	99.0%	1.8%	2.9% per year		3.6%	1.2%	0.1%	0.4%	0.2%
Nielsen-Kudsk 2017[119]	MReg (ICH patients)	ACP+Am	151	72±8.7	–/3.9	100%	6	97.7%	–	17 (vs 81) ischaemic strokes per 1,000 patient years 116 (vs 95) recurrent ICH per 1,000 patient years		4%	0.7%	0.7%	0.7%	0

ACP: AMPLATZER Cardiac Plug; AM: Amulet; FU: follow-up; ICH: intracranial haemorrhage; MRCT: multicentre randomised controlled trial; MReg: multicentre registry; Nded Dev.: non-dedicated devices for LAAO (AMPLATZER PFO, ASD, VSD Occluder); OAC: oral anticoagulation; SAE: serious adverse event; SReg: single-centre registry; TIA: transient ischaemic attack

Efficacy and safety of left atrial appendage closure with WATCHMAN in patients with or without contraindication to oral anticoagulation: 1-Year follow-up outcome data of the EWOLUTION trial. Boersma Heart Rythm 2017

Registre multicentrique prospectif
1025 patients 1 an.
Age M 73,4 ans
CHAD2DS2vasc M 4,5, HAS Bled > 3 40 %
ATCD AIT AVC 30 %
ATCD saignement majeur 31,3 %
Succès implantation 98 %
Absence de fuite 99,7 %
Antiagrégant 83 %
Thrombus prothèse 3,7 % indpdt AAP ou AVK, sans symptôme.
AVC 1,1 %
Hémorragie majeure 2,6 % (2,3 % non lié à la prothèse)

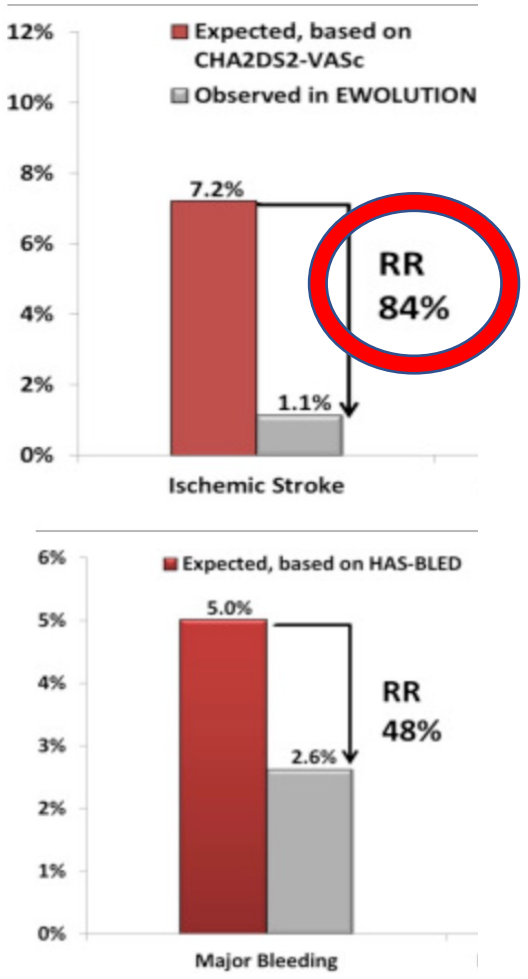


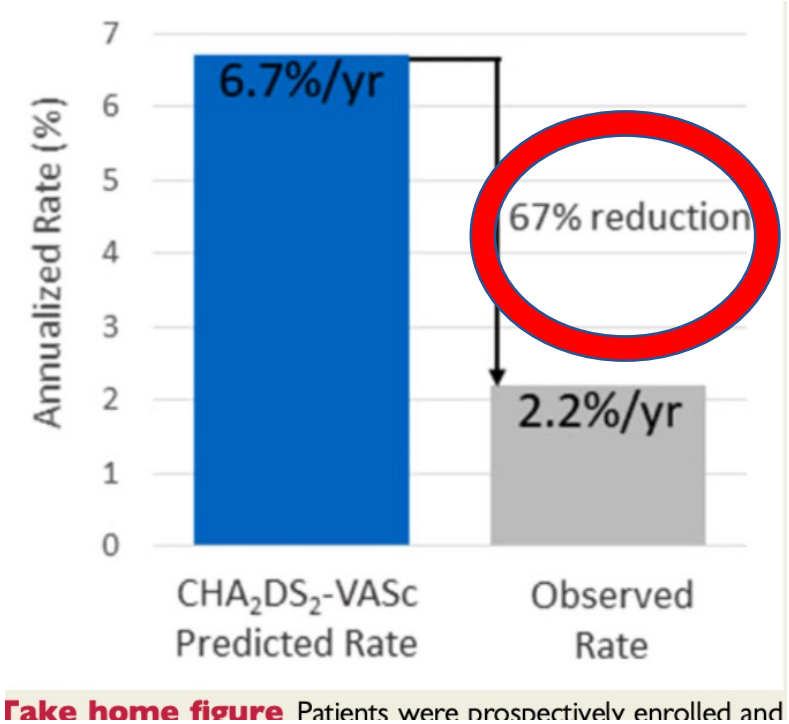
Table 3. Listing of all major cardiac adverse events within 7 d of implan and other device-/procedure-related serious adverse events

Major adverse cardiac events* ≤7 d	18 (1.8%)
All deaths (0–7 d)†	4
Major bleeding	9
Cardiac tamponade/significant PE	3
Device embolization requiring surgery	1
Device embolization snared	1
Stroke	None
Systemic embolism	None
Myocardial infarction	None
Other events requiring surgery/major intervention	None
Other periprocedural serious adverse events ≤7 d	15 (1.5%)
Vascular complications @ groin	4
Air embolism (coronary)	2
Minor pericardial effusion (untreated)	2
Reinterventions due to incomplete seal	2
Minor bleeding (untreated)/hematoma	2
TIA	1
Hypotension	1
Adverse reaction to anesthesia	1

1 embolie gazeuse et 3 non lié procédure

Left atrial appendage occlusion with the AmplatzerTM AmuletTM device: full results of the prospective global observational study . Hildick-Smith EHJ 2020

1088 Pts
CHAD2DS2Vasc 4,2,
HAS BLED 3,3, 71 % ATCD saignemt majeur, 82,8 % CI AC
Succès implant 99 %.
AAP sortie 80,2 %
Absence fuite 98,4 %
DRT 1,6 %
AVC 2,2 %/an
Hémorragie majeure 10% (DAPT ++ intestinal ++, première année, 4 % 2e)
Complications graves < 7 j 4 % (DC 0, 3 %, AVC 0,4 %, embol device 0,2 %, vasculaire 1,3 %)`
DC 5,5 % sur 2 ans



Take home figure Patients were prospectively enrolled and

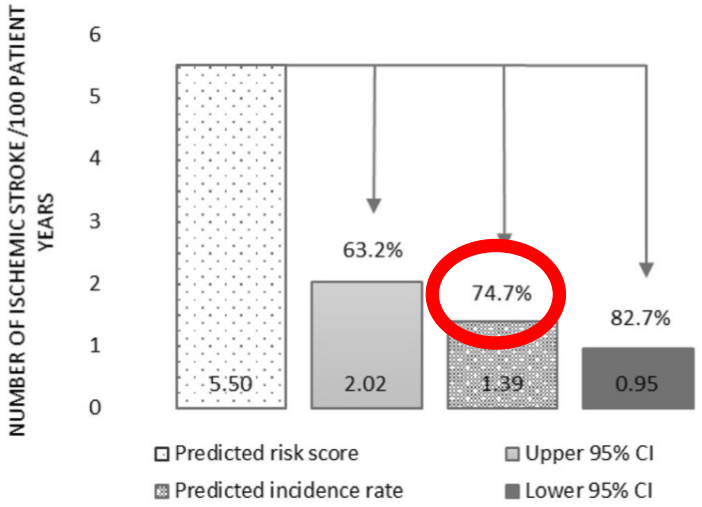
Journal of Interventional Cardiac Electrophysiology
https://doi.org/10.1007/s10840-021-00953-9

2020

REVIEWS

Clinical follow-up of left atrial appendage occlusion in patients with atrial fibrillation ineligible of oral anticoagulation treatment—a systematic review and meta-analysis

29 études observationnelles
7951 patients
Réduction risque AVC
74,7 %



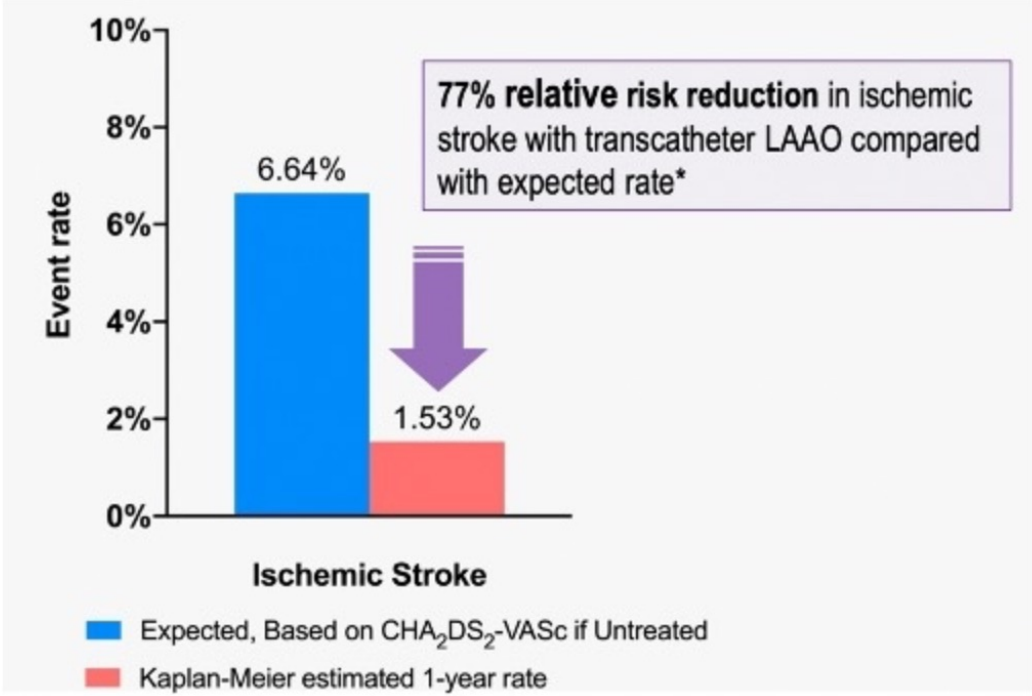


Figure 1 **: taux d'AVC ischémique à 1 an dans le groupe fermeture de l'auricule gauche comparé au taux attendu selon le CHADS-VASC**

NCDR LAO registry 1 an
2016-2018 Watchman
36 681 pts

CHADS2 M 4,8
Age M 76 ans
ATCD 70 % saignements majeurs

Comparative Effectiveness of Left Atrial Appendage Occlusion Versus Oral Anticoagulation by Sex

Circulation 2023

METHODS: Using Medicare claims data from 2015 to 2019, we identified LAAO-eligible beneficiaries and divided them into sex subgroups. Patients receiving LAAO were matched 1:1 to those receiving anticoagulation alone through propensity score matching. The risks of mortality, stroke or systemic embolism, and bleeding were compared between matched groups with adjustment for potential confounding characteristics in Cox proportional hazards models.

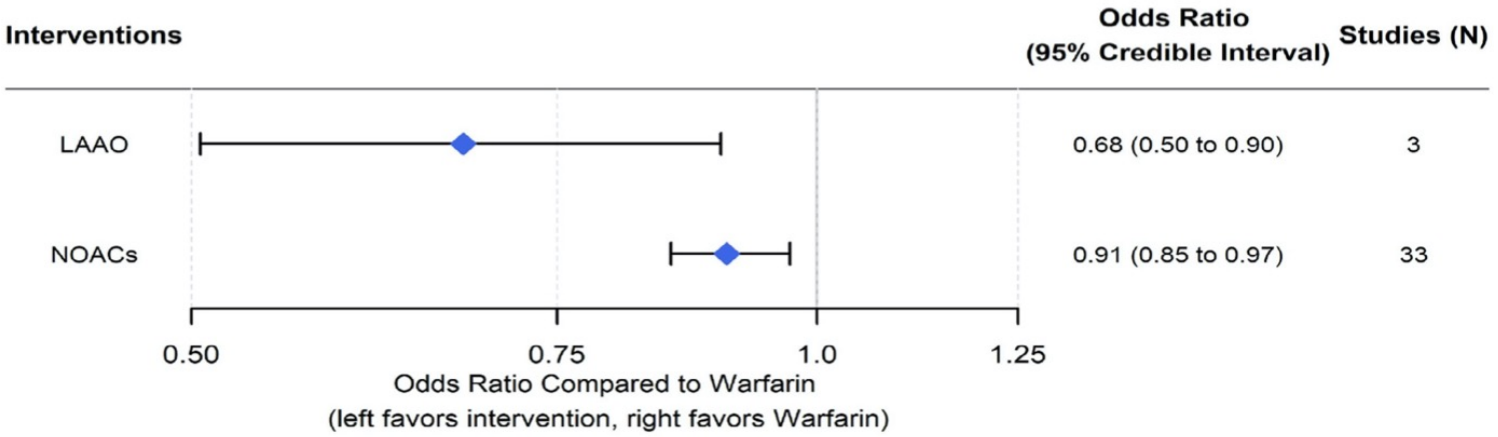
RESULTS: Among women, 4085 LAAO recipients were matched 1:1 to those receiving anticoagulation; among men, 5378 LAAO recipients were similarly matched. LAAO was associated with a significant reduction in the risk of mortality for women and men (hazard ratio [HR], 0.509 [95% CI, 0.447–0.580]; and HR, 0.541 [95% CI, 0.487–0.601], respectively; $P<0.0001$), with a similar finding for stroke or systemic embolism (HR, 0.655 [95% CI, 0.555–0.772]; and HR, 0.649 [95% CI, 0.552–0.762], respectively; $P<0.0001$). Bleeding risk was significantly greater in LAAO recipients early after implantation but lower after the 6-week periprocedural period for women and men (HR, 0.772 [95% CI, 0.676–0.882]; and HR, 0.881 [95% CI, 0.784–0.989], respectively; $P<0.05$).

CONCLUSIONS: In a real-world population of older Medicare beneficiaries with AF, compared with anticoagulation, LAAO was associated with a reduction in the risk of death, stroke, and long-term bleeding among women and men. These findings should be incorporated into shared decision-making with patients considering strategies for reduction in AF-related stroke.

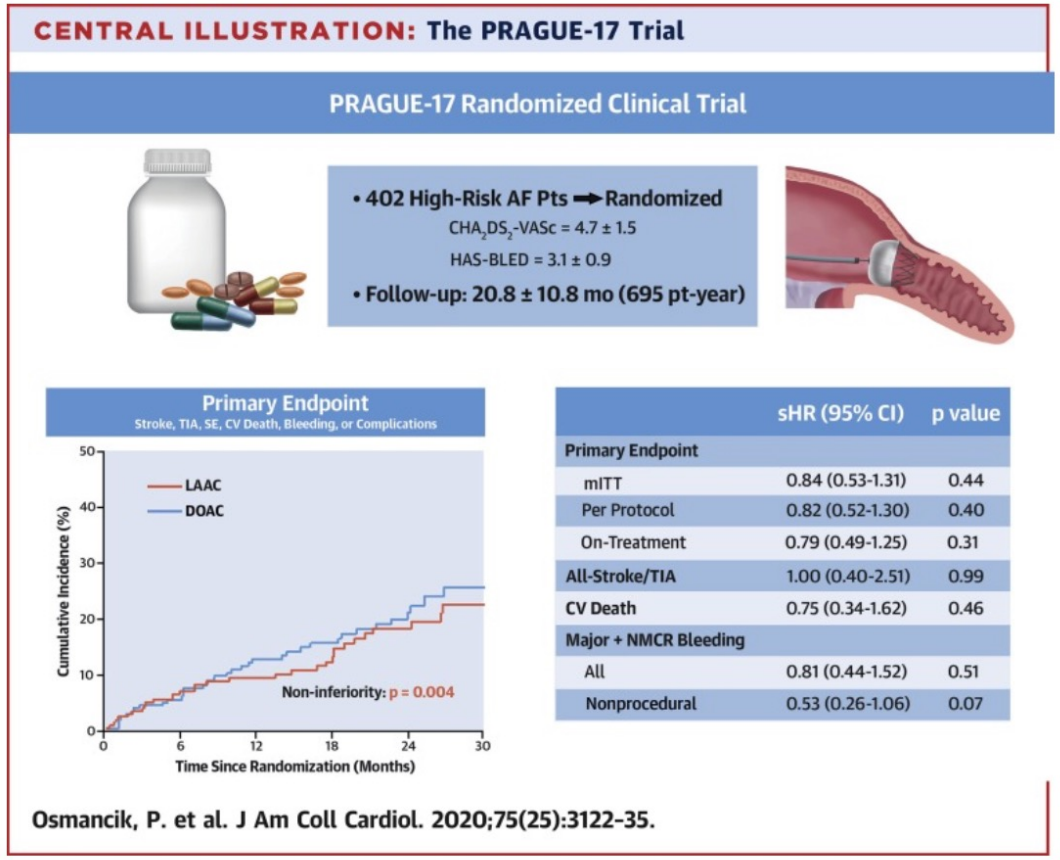
Score de propension 9463 pts. Age M 76 ans, FAG vs AC, CHADS 5,2, 52 % AOD 48 % AVK.
Diminution DC, AVC, saignements

Meta-Analysis Comparing Left Atrial Appendage Occlusion, Direct Oral Anticoagulants, and Warfarin for Nonvalvular Atrial Fibrillation. Am J Cardiol 2022

- 40 RCT (5 FAG). 95469 Patients
- Etude mortalité: FAG > AOD > AVK.



Left Atrial Appendage Closure Versus Direct Oral Anticoagulants in High-Risk Patients With Atrial Fibrillation

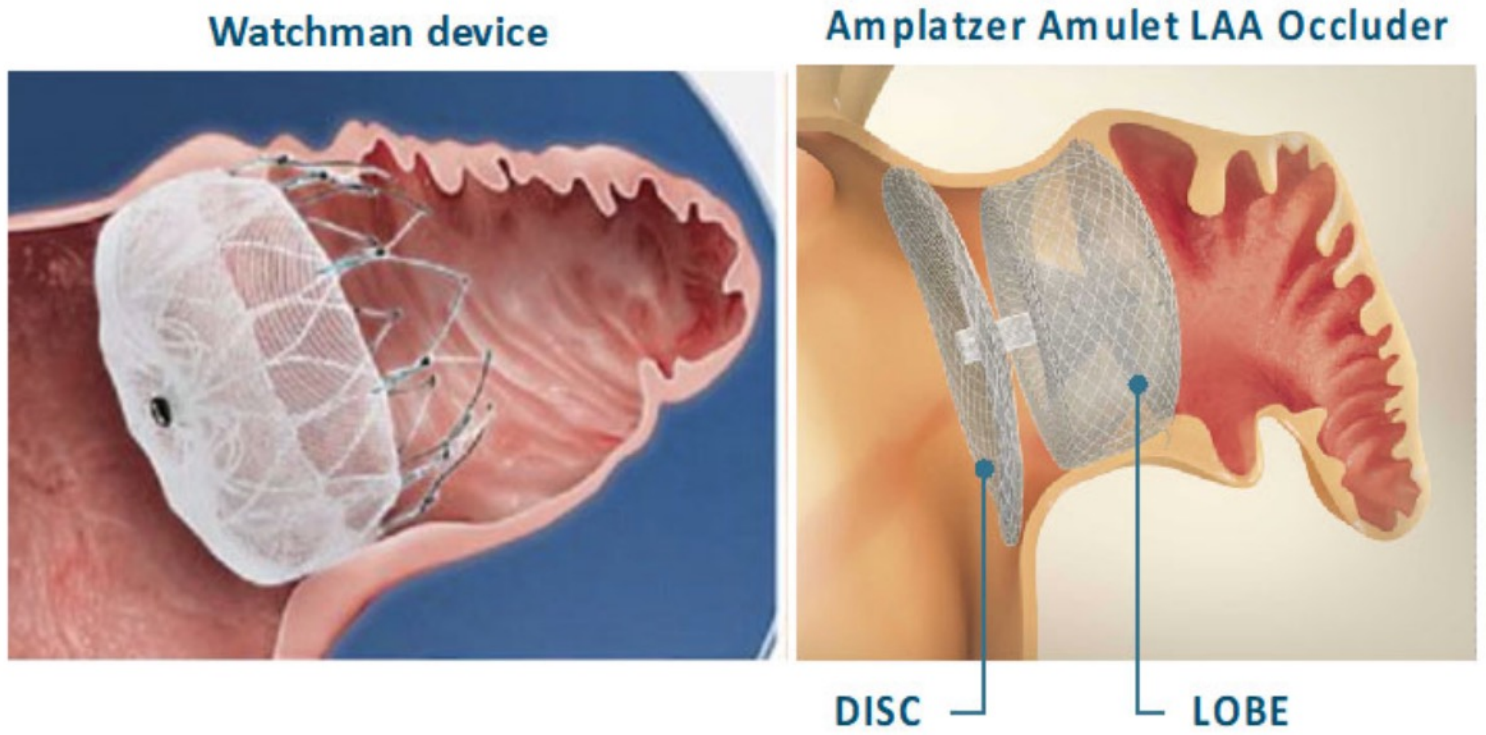


Prague 17 Trial

RCT étude de non infériorité
402 patients suivi 3,5 ans
Primary endpoint: AVC, AIT, DC cardiovasc, saignement, complication device°
Age M 73 ans
CHADS 4,7
ATCD saignement 47,8 %
Amulet 62 % W 38 %
Eliquis 95 %
DRT 3,4 % leak > 5 mm 2,2 %
Complication lié au LAAC 4,5 %
(4/10 centres de novo)

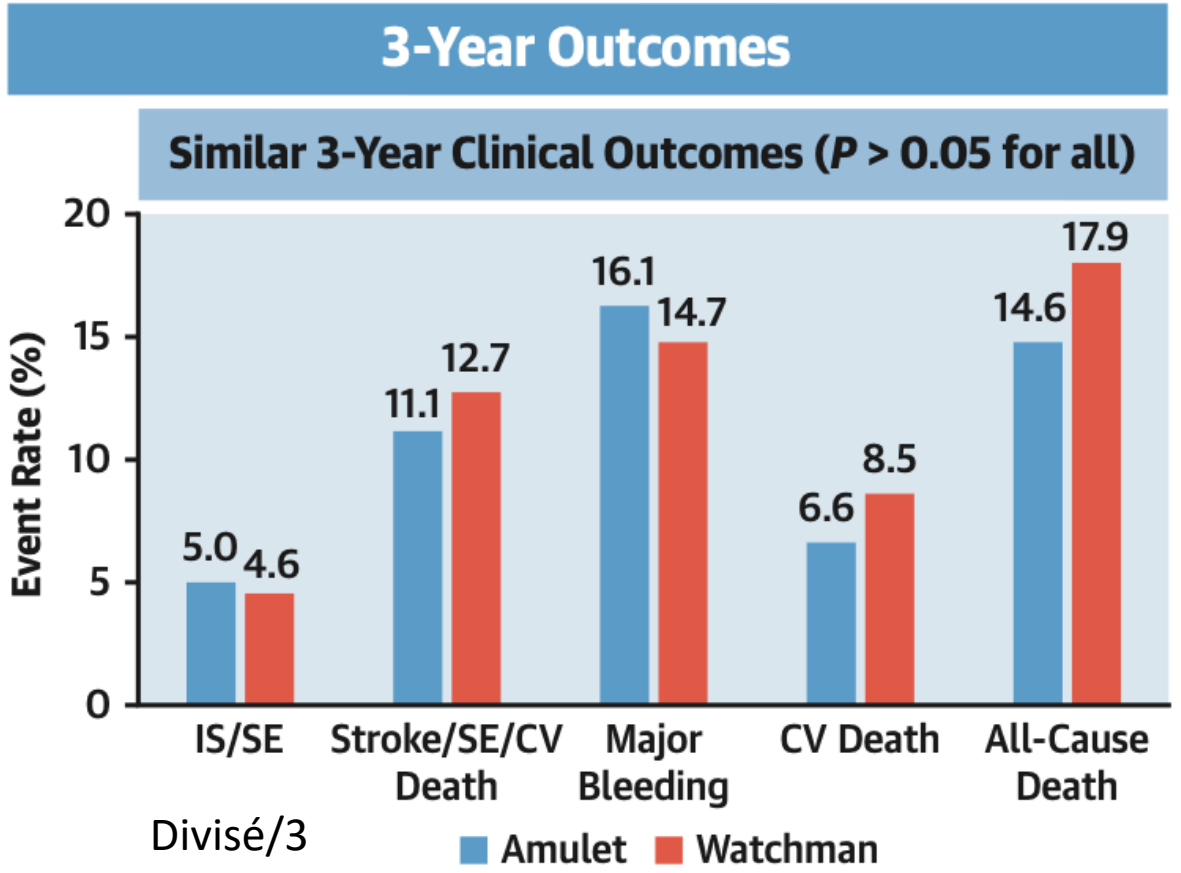
Pas de différence FAG AOD
10.99% with LAAC vs 13.42%
Moins de saignement

Dispositifs équivalents ?



3-Year Outcomes From the Amplatzer Amulet Left Atrial Appendage Occluder Randomized Controlled Trial (Amulet IDE) JACC 2023

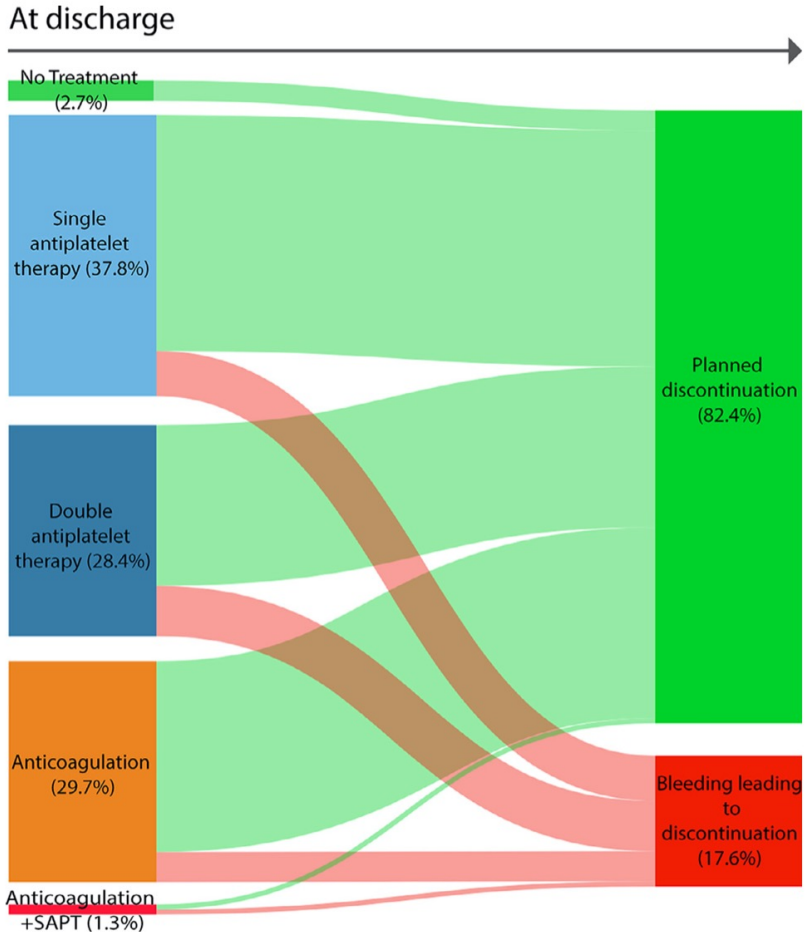
Randomized study A et W
1878 pts,18 mois
Efficacité sécurité =
Occlusion A 98,9 vs W 96,8 % (fuite < 5mm) S
Complication procédures + A mais diminue avec c apprentisage (péricarde embolisation)
Risque AVC 1,6 %/an



Divisé/3

Lakkireddy D, et al. J Am Coll Cardiol Intv. 2023;16(15):1902-1913.

Autres études



Early Discontinuation of Antithrombotic Treatment Following Left Atrial Appendage Closure

Etude rétrospective score de propension.

1082 patients FAG

148 Arrêt ds les 6 mois AAP : arrêt moyen 3 mois

SUIVI 2 ans

Pas différence: DC, hémorragie, AVC

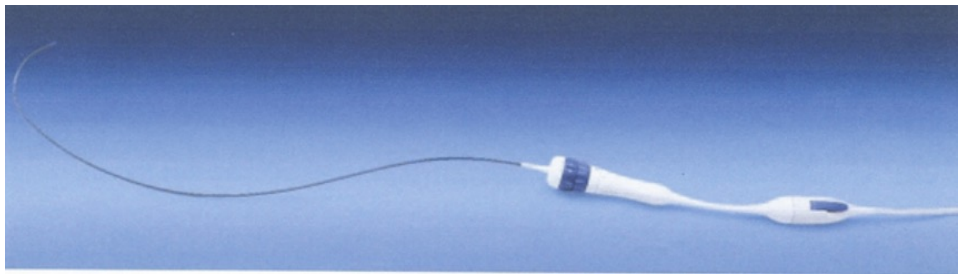
Vérification imagerie absence DRT préférable

Am J Cardiol 2022

> Am J Cardiovasc Dis. 2020 Dec 15;10(5):538-547. eCollection 2020.

American journal of cardiovascular disease

Intracardiac echocardiography versus transesophageal echocardiography for left atrial appendage closure: an updated meta-analysis and systematic review

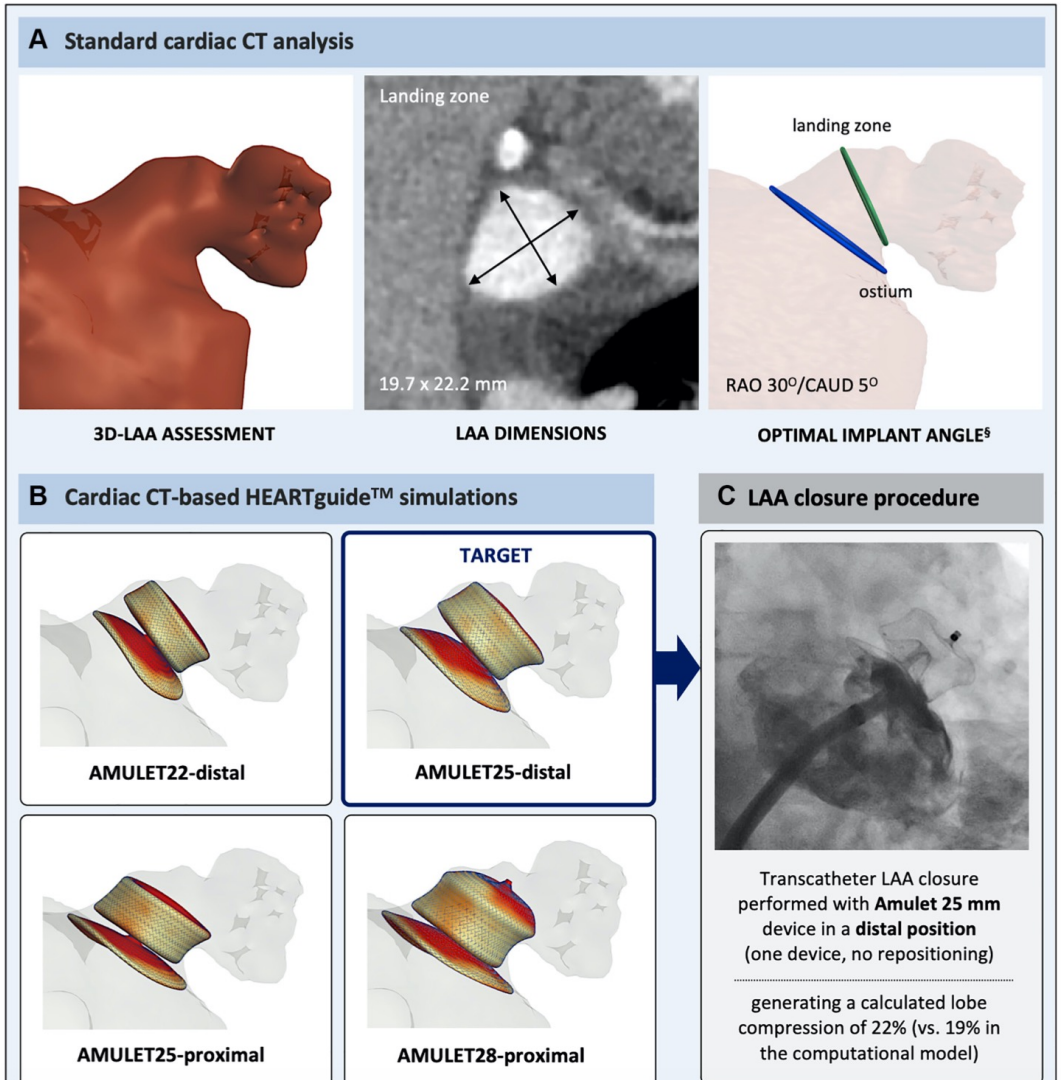


No significant difference was observed in procedure duration, fluoroscopy time and contrast volume used while a trend towards decreased hospital length of stay was seen with the use of ICE. Thus, our updated meta-analysis **shows ICE is as effective and safe as TEE for implantation of LAAC devices.**

Mais cher !!

Impact of Computational Modeling on Transcatheter Left Atrial Appendage Closure Efficiency and Outcomes

JACC 2023



Rôle de L'IA
FEOPS System (belge): simulation
197 pts
Moins de repositionnement, moins de dispositif utilisé.

ESC European Society of Cardiology
Europace (2022) **00**, 1–10
https://doi.org/10.1093/europace/euac181

Combined atrial fibrillation ablation and left atrial appendage occlusion procedure in the United States: a propensity score matched analysis from 2016–2019 national readmission database

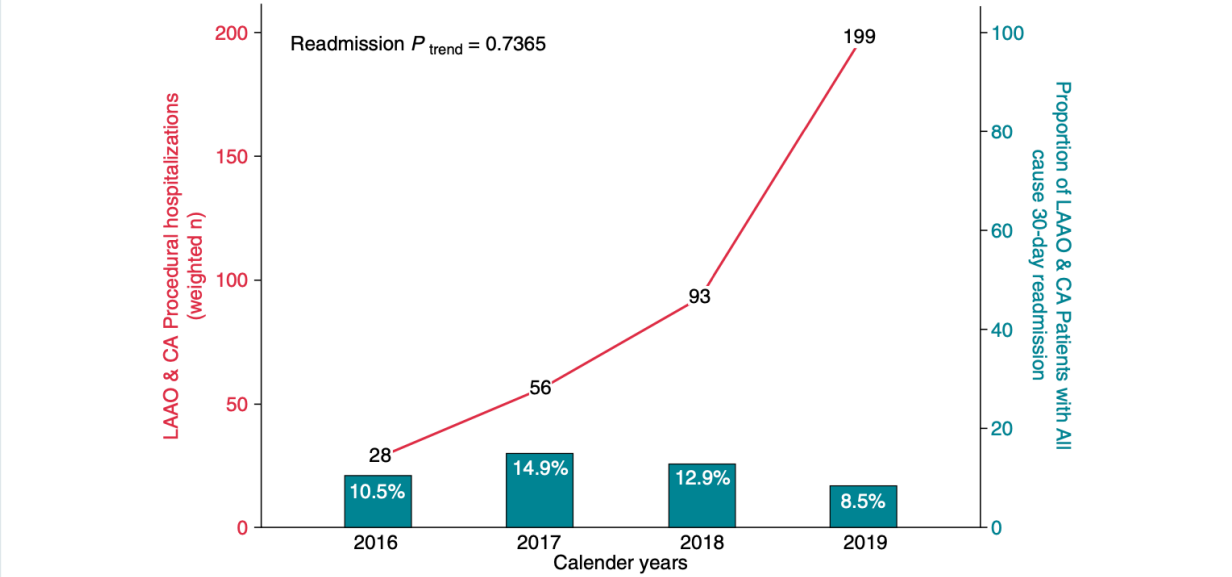


Figure 1 Incidence and all-cause 30-day readmission trends among patients undergoing LAAO and CA procedure in the United States. LAAO, Left Atrial Appendage Occlusion device; CA, Percutaneous Atrial Fibrillation Ablation.

Etude rétrospective, score de propension.
375 patients
FAG + RF FA vs FAG Vs RF FA
Critère: événement cardio-vasculaire majeur.

Augmentation des procédures au Etats Unis.
Pas plus de complications
ni réhospitalisation à 30 jours

Left Atrial Appendage Occlusion During Cardiac Surgery to Prevent Stroke. LAOOS III Trial. NEJM 2021

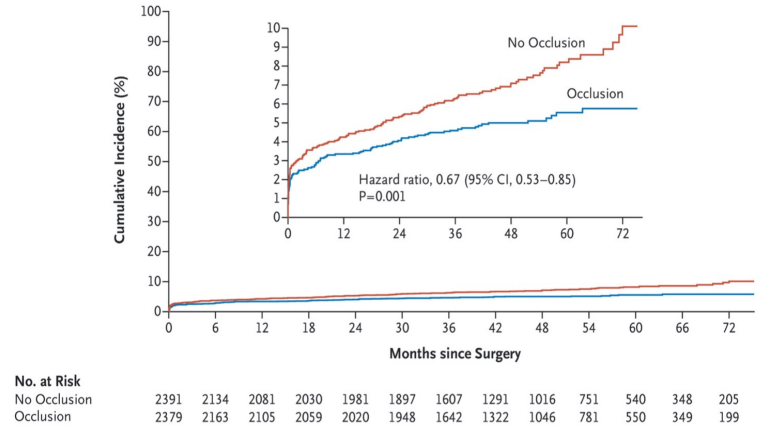
- **RCT 4770 pts** chirurgie cardiaque , ATCD FA (perm 30 %, Pers 20 %, Parox 50 %)

et CHA2DS2vasc ≥ 2 M 4,2

- Durée 3,8 ans.
- **FAG chirurgicale vs pas de fermeture**
- Age M 71 ans, pas de valve mécanique
- Tps CEC 119 vs 113 mn
- Anticoagulant 75 % vs 78 %
- **Endpoint: AVC ou embolie systémique 4,8 Vs 7 % (p=0,01) à 3,8 an**

  AVC 4,6 % Vs 6,9 %.

DC et hémorragie =



Conclusion: supériorité FAG pendant chirurgie en gardant les anticoagulants.

EHRA/EAPCI expert consensus statement on catheter-based left atrial appendage occlusion – an update 2020

Table 15. Atrial fibrillation patients who are not eligible ("contraindicated") for long-term oral anticoagulation and require prevention of stroke and embolism.

Clinical situation and therapeutic concept	Consensus statement	Icon
AF patients with CHA_2DS_2-VASc score ≥2 (3 in females) who have absolute contraindications for long-term OAC may be considered for LAAO if a minimum period (2-4 weeks) of a single antiaggregant can be given	"Should do this"	

AF: atrial fibrillation; LAAO: left atrial appendage occlusion; OAC: oral anticoagulation

Table 16. Patients with an elevated bleeding risk during long-term oral anticoagulation.

Clinical situation and therapeutic concept	Consensus statement	Icon
In patients with an elevated bleeding risk during long-term oral anticoagulation (e.g., post intracranial bleeding) an individual risk-benefit assessment needs to be carried out between oral anticoagulation and LAA occlusion	"Should do this"	
In patients with an elevated bleeding risk during long-term OAC, LAA occlusion may be considered	"May do this"	

TABLE 3 Overview of Current and Planned Randomized Trails on Percutaneous LAAO

Study Name/Sponsor	Trial Size	Trial Objective	Intervention	Control	Primary Outcome Measures	f/u
CHAMPION-AF (NCT04394546) Boston Scientific	3,000	Assess the role of LAAO in NVAF patients who are eligible for long-term DOAC	LAAO with Watchman/ FLX	DOAC	Composite of ischemic stroke or SE; Composite of ischemic stroke, SE, or CV death (NI); nonprocedural major bleeding (S)	3 y
CATALYST (NCT04226547) Abbott	2,650	Assess the role of LAAO in NVAF patients who are eligible for long-term DOAC	LAAO with Amulet	DOAC	Composite of ischemic stroke or SE; Composite of ischemic stroke, SE, or CV death (NI); nonprocedural major bleeding (S)	3 y
OCCLUSION-AF (NCT03642509) Aarhus University	750	Assess the role of LAAO in NVAF patients who are eligible for long-term DOAC	LAAO with Amulet or Watchman	DOAC	Composite of stroke, SE, major bleeding, and all-cause mortality	5 y
CLOSURE-AF (NCT03463317) Charite University	1,512	Assess the role of LAAO in NVAF patients with high bleeding risk or contraindication to OAC	CE-mark/approved LAAO device	DOAC or VKA	Composite of stroke, SE, major bleeding (BARC type 3-5), CV, or unexplained death	2 y
STROKECLOSE (NCT02830152) Nordic Universities	750	Assess the role of LAAO in NVAF patients with an ICH within 12 mo	LAAO with Amulet	Medical therapy	Composite of stroke, SE, major bleeding, and all-cause mortality	5 y
CLEARANCE (NCT04298723) Jena University	550	Assess the role of LAAO in NVAF patients with a history of ICH	LAAO with Watchman FLX	Medical therapy	Composite of stroke, SE, BARC type 2-5 bleeding, and CV or unexplained death	2 y
COMPARE-LAAO (NCT04676880) R&D Cardiologie	609	Assess the role of LAAO in NVAF patients with contraindication for OAC	LAAO with Watchman FLX or Amulet	Antiplatlets or no therapy	Time to first occurrence of stroke; Time to first occurrence of the stroke, TIA, or SE; Procedural complications	5 y
OPTION (NCT03795298) Boston Scientific	1,600	Assess the role of LAAO in NVAF patients undergoing catheter ablation for AF	LAAO with Watchman/ FLX	DOAC	Composite of stroke, death, or SE (NI); nonprocedural major bleeding (S)	3 y
WATCH-TAVR (NCT03173534) Boston Scientific	350	Assess the role of LAAO in NVAF patients undergoing TAVR	TAVR + LAAO with Watchman	TAVR + medical therapy	All-cause mortality, stroke, and bleeding	1 y
CONFORM[a] (NCT05147792) Conformal Medical	1,400	Assess the performance of the CLAAS device (head-to-head device trial)	LAAO with CLASS device	LAAO with Watchman FLX or Amulet	Procedure-related complications, all-cause death, major bleeding (12 mo); ischemic stroke or SE (18 mo)	1.5 y
WAVECREST2[a] (NCT03302494) Coherex Medical	1,550	Assess the performance of the WaveCrest device (head-to-head device trial)	LAAO with WaveCrest	LAAO with Watchman	Procedure-related complications (45 d), all-cause death; major bleeding; ischemic stroke or SE (24 mo)	2 y

[a]Active, not yet recruiting.

BARC = Bleeding Academic Research Consortium; CE = Conformite Europeenne; CLAAS = Conformal; CV = cardiovascular; DOAC = direct oral anticoagulant; ICH = intracranial hemorrhage; LAAO = left atrial appendage occlusion; NI = noninferiority; NVAF = nonvalvular atrial fibrillation; OAC = oral anticoagulation; S = superiority; SE = systemic embolization; TAVR = transcatheter aortic valve replacement; TIA = transient ischemic attack; VKA = vitamin-K antagonist.

FUTUR RCT +++

vs AOD Résultats 2029

vs AOD

vs AOD

vs AOD

vs AAP OU RIEN
vs AOD chez pts RF FA Résultats 2025

Différents dispostifs

+ LAOOS 4 1500 pts W + AOD vs AOD Résultats 2029
+ SIMPLIFY 1500pts W Aspirine vs DAPT Vs ½ dose AOD Résulats 2027

CONCLUSION

- Technique actuellement bien maitrisée (expérience, technique, sizing).
- Centre spécialisé avec chirurgie cardiaque.
- Nouvelles Etudes +++
- Extension des indications ? CHADS 2, alternative aux AOD.
- Ablation FA et FAG combinée ?

Anti facteur XI ?