



29-31
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Valve in valve aortique

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CONFLITS D'INTERET

Aucun conflit d'intérêt

Dégénérescence sévère symptomatique de bioprothèse aortique chirurgicale

Aucune donnée randomisée
entre le ViVA et la chirurgie

redux

2021 ESC/EACTS Guidelines for the management of valvular heart disease

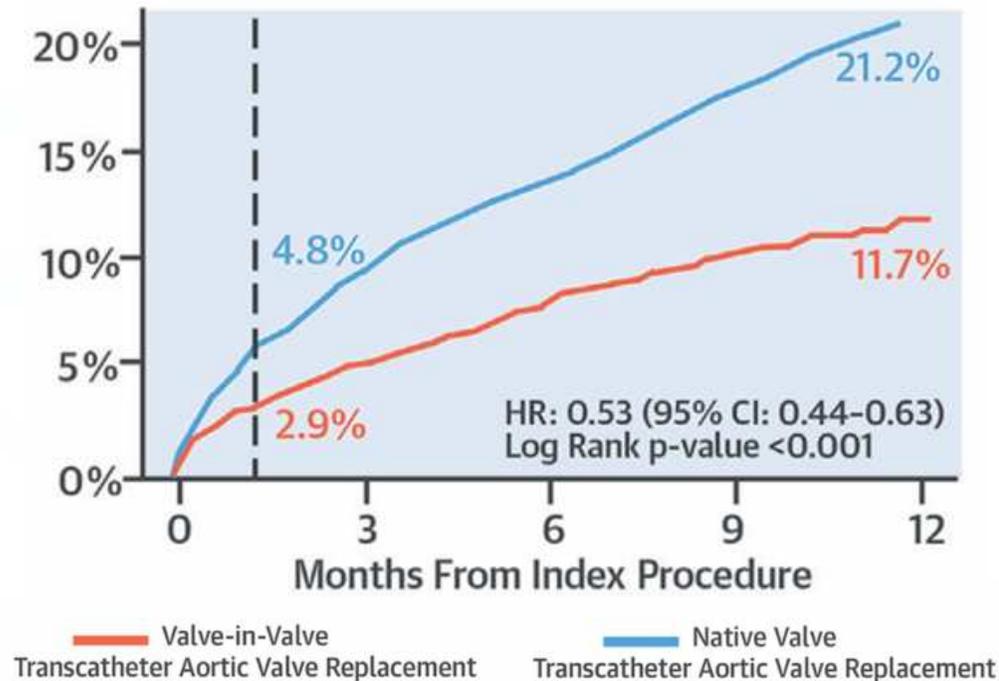
Bioprosthetic failure		
Reoperation is recommended in symptomatic patients with a significant increase in transprosthetic gradient (after exclusion of valve thrombosis) or severe regurgitation.	I	C
Transcatheter, transfemoral valve-in-valve implantation in the aortic position should be considered by the Heart Team depending on anatomic considerations, features of the prosthesis, and in patients who are at high operative risk or inoperable. ⁵²⁹	IIa	B
Transcatheter valve-in-valve implantation in the mitral and tricuspid position may be considered in selected patients at high risk for surgical re-intervention. ^{382,531,532}	IIb	B
Reoperation should be considered in asymptomatic patients with significant prosthetic dysfunction if reoperation is low risk.	IIa	C

ViVA : les données des registres

Registre : ViVA versus TAVI valve native (STS/ACC)

- Données matched
- 1150 ViVA versus 2259 NV-TAVR
- BEV et SEV

A. Mortality



Tuzcu et al, J Am Coll Cardiol 2018;72:370-82

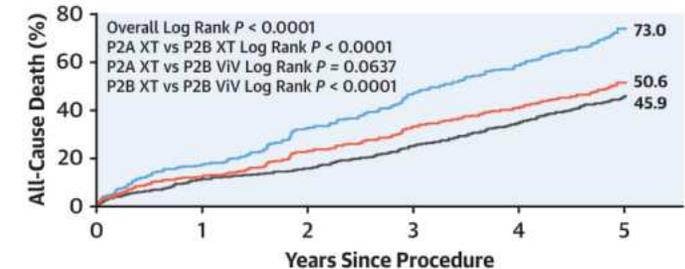
Registre partner 2

- 365 patients ViV
- ViV compatible avec Sapien XT 23 ou 26 mm
- >70 % Valve Chirurgicale ≥ 23 mm

Transcatheter Valve-in-Valve (ViV) 5-Year Outcomes in High Surgical Risk Patients



A



No. at risk:

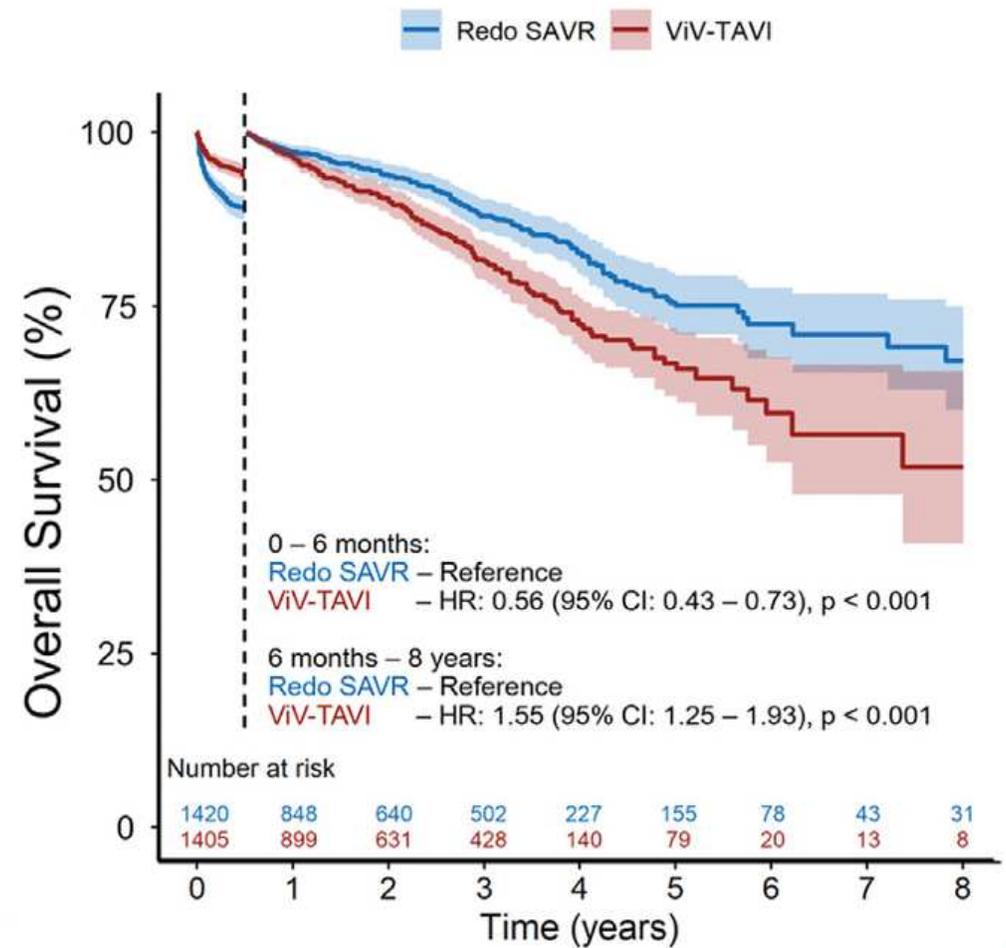
	0	1	2	3	4	5
— P2B XT (Inoperable)	280	217	177	147	111	46
— P2B XT ViV (High Risk)	365	320	274	234	190	141
— P2A XT (Intermediate Risk)	974	854	800	696	592	311

Hahn RT, et al. J Am Coll Cardiol Intv. 2022;15(7):698-7

ViVA vs Chirurgie redux

Long-Term Outcomes of Valve-in-Valve Transcatheter Aortic Valve Implantation Versus Redo Surgical Aortic Valve Replacement: Meta-Analysis of Kaplan–Meier –Derived Data

- Méta-analyse de 16 études observationnelles : 4373 patients
- Population appariées, analyse des courbes de survie.
- Analyse Landmark en fonction du temps : favorable au TAVI < 6 mois, favorable à la redoChirurgie après 6 mois
- Beaucoup de biais et de facteurs confondants (âge, co-morbidité, taille de prothèse plus petite dans groupe ViV).



La procédure ViVA : les principaux défis

- **Obstruction coronaire** : alignement commissural, Cheminée, Basilica, Short Cut
- **Mismatch** : Type de valve, Hauteur d'implantation, Fracture de Valve
- **Malposition, Fuite para-prothétique**
- **Thrombose de valve** : alignement commissural, ACO

Obstruction coronaire

Registre VIVID 1612 patients ViVA

- **2,3 %** : 3 à 4 X plus fréquente par rapport au TAVI valve native
- Dépend du type de prothèse chirurgicale
- 91,7 % obstruction TC

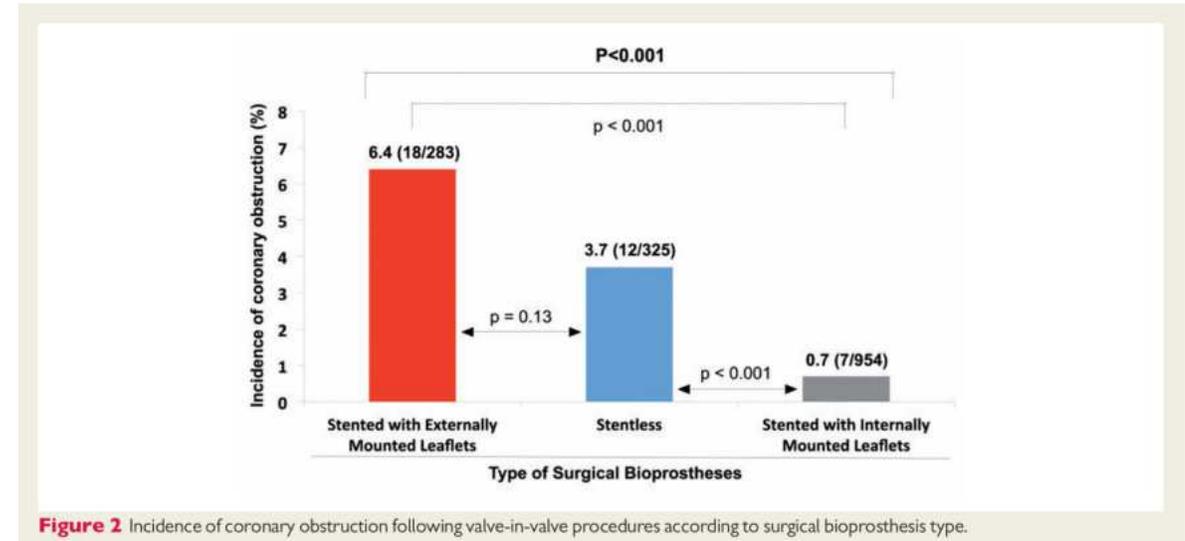


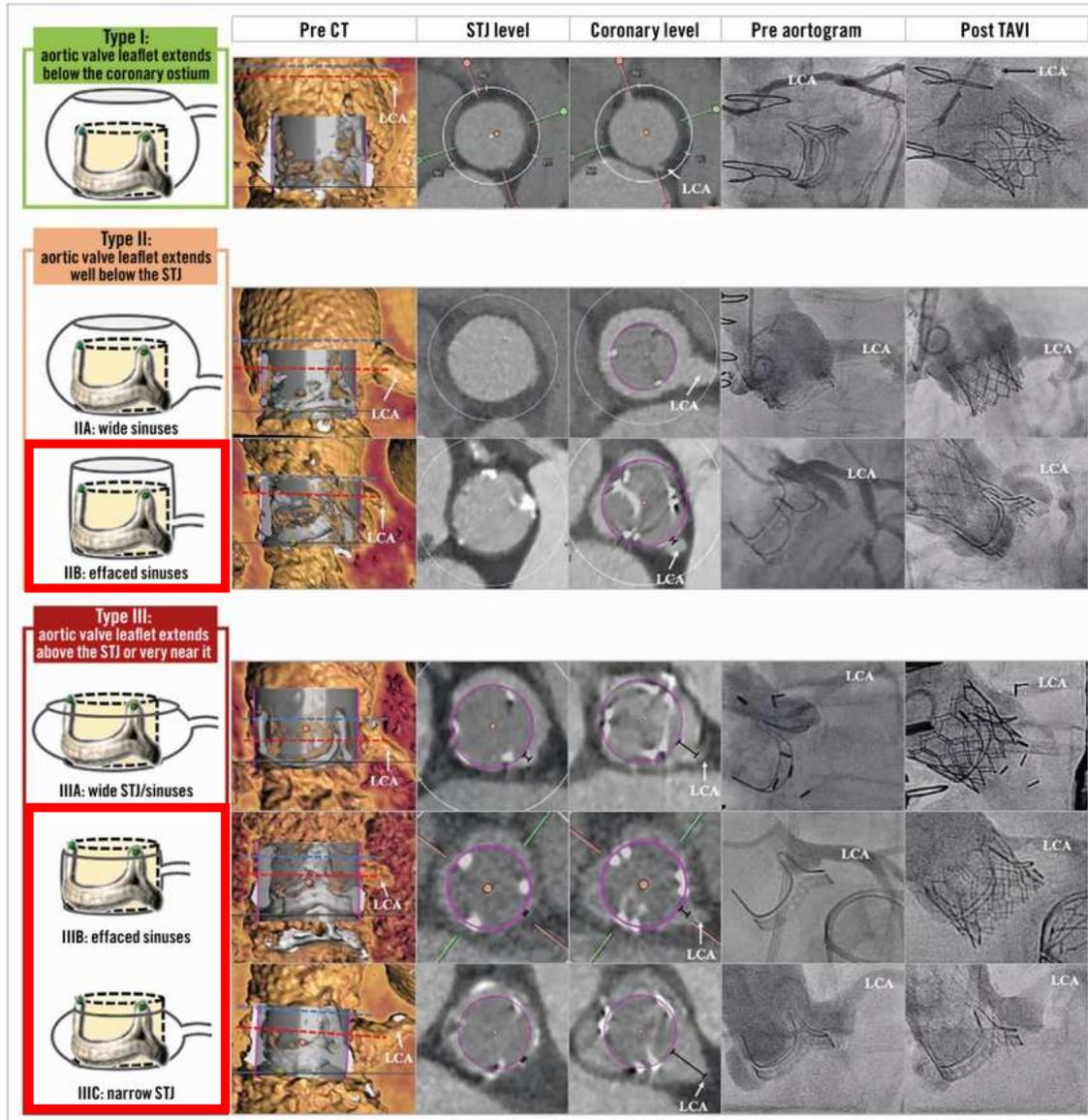
Table 4 Predictors of coronary obstruction following valve-in-valve procedures

	Univariable OR (95% CI)	P-value	Multivariable model OR (95% CI)	P-value
Model for the overall population (n = 1612)				
CABG to the left system	0.36 (0.13–1.03)	0.056	0.38 (0.13–1.09)	0.07
STS-PROM	1.03 (0.99–1.06)	0.068	1.02 (0.99–1.05)	0.21
Post-dilatation	2.05 (0.92–4.56)	0.080	1.82 (0.8–4.14)	0.15
Stented with external mounted leaflet or stentless bioprosthesis	7.07 (3.09–16.2)	<0.001	7.67 (3.14–18.7)	<0.001
Model for the computed tomography cohort (n = 110)				
VTC ^a	0.18 (0.08–0.39)	<0.001	0.22 (0.09–0.51)	<0.001
Sinus of Valsalva mean diameter	0.70 (0.58–0.83)	<0.001	0.95 (0.72–1.25)	0.71
Stented with external mounted leaflet or stentless bioprosthesis	4.90 (1.51–15.9)	0.008	4.30 (0.85–21.7)	0.08

Abbreviations as in Tables 1 and 3.

^aPer unit increase.

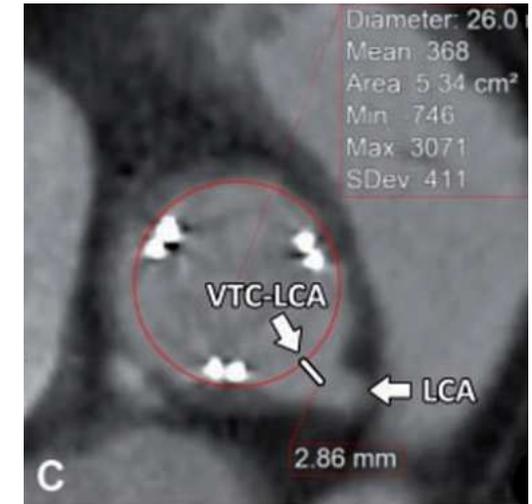
Obstruction coronaire, évaluation du risque : Classification VIVID



Mesure

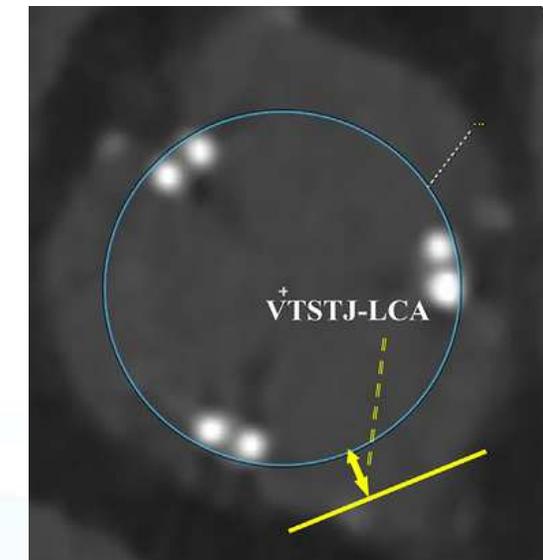
VTC :

- virtual transcatheter heart valve to coronary ostium
- < 4 mm : basé sur des données publiées



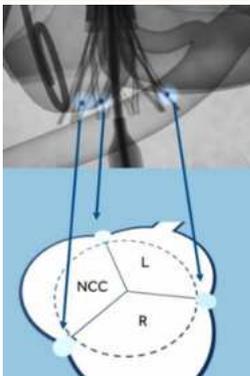
VTJST :

- virtual transcatheter heart valve to sinotubulat jonction
- < 2,5 mm entre 2,5 et 3,5 mm

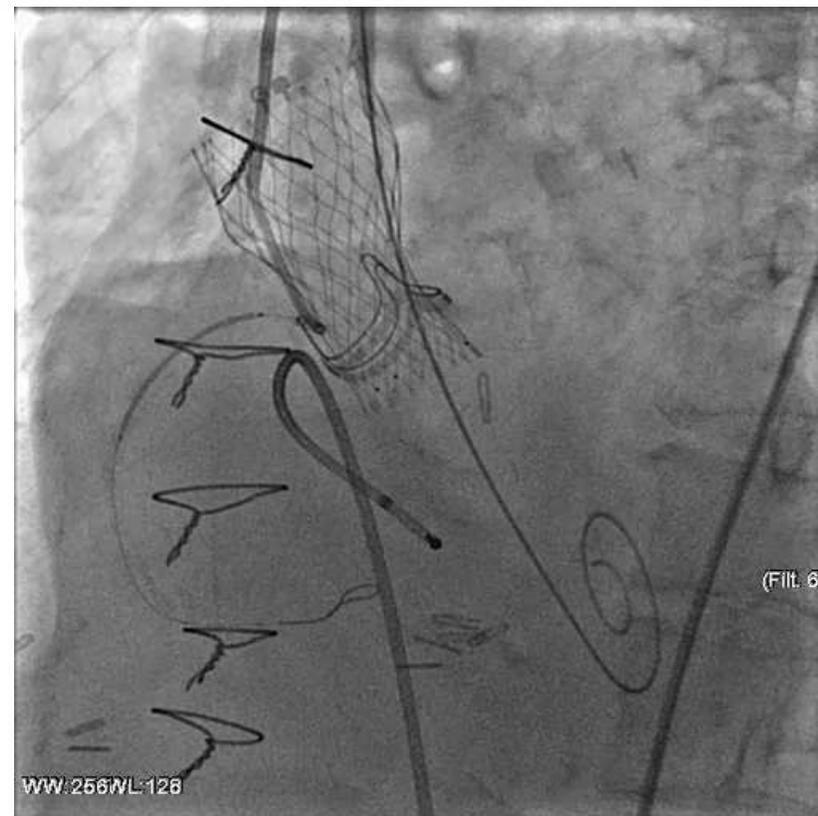


Stratégie de prévention de l'obstruction coronaire

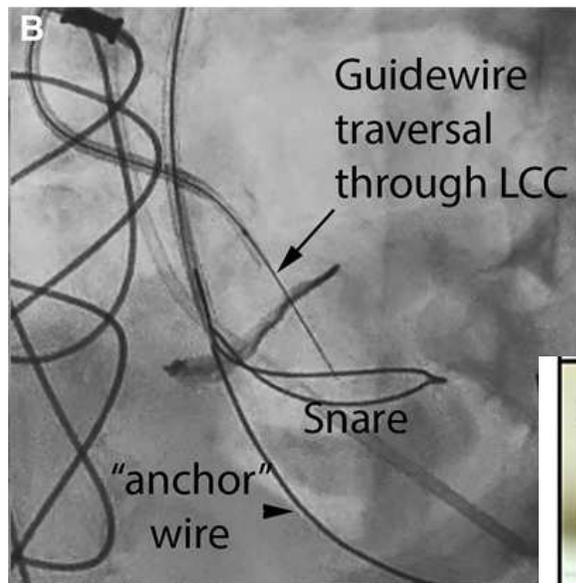
➤ Alignement « coronaire »



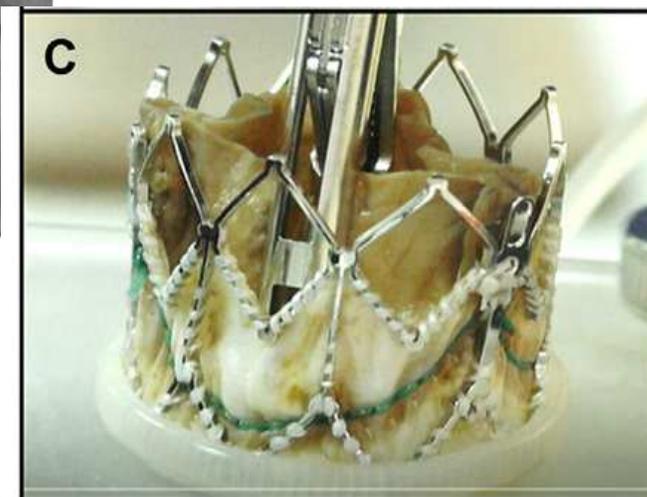
➤ Chimney stenting



➤ Technique de lacération



➤ BASILICA



➤ ShortCut

Chimney vs Basilica

Clinical success was similar between the 2 techniques (chimney 97.2% vs BASILICA 96.9%; $P = 0.92$).

TABLE 4 Periprocedural Complications and Antithrombotic Therapy at Discharge

	Chimney (n = 71)	BASILICA (n = 97)	Overall (N = 168)	P Value
Procedural mortality	1 (1.4)	1 (1.0)	2 (1.2)	0.82
Periprocedural MI	1 (1.4)	3 (3.1)	4 (2.4)	0.48
Cardiac tamponade	1 (1.4)	0 (0.0)	1 (0.6)	0.24
Stroke				
Not disabling	2 (2.8)	2 (2.1)	4 (2.4)	0.75
Disabling	0 (0)	0 (0)	0 (0)	—

Paravalvular leak				
No/trace	33 (46.4)	85 (88.5)	117 (70.4)	<0.001
Mild	31 (43.6)	11 (11.4)	42 (25.3)	<0.001
Moderate	7 (9.8)	0 (0.0)	7 (4.2)	0.002

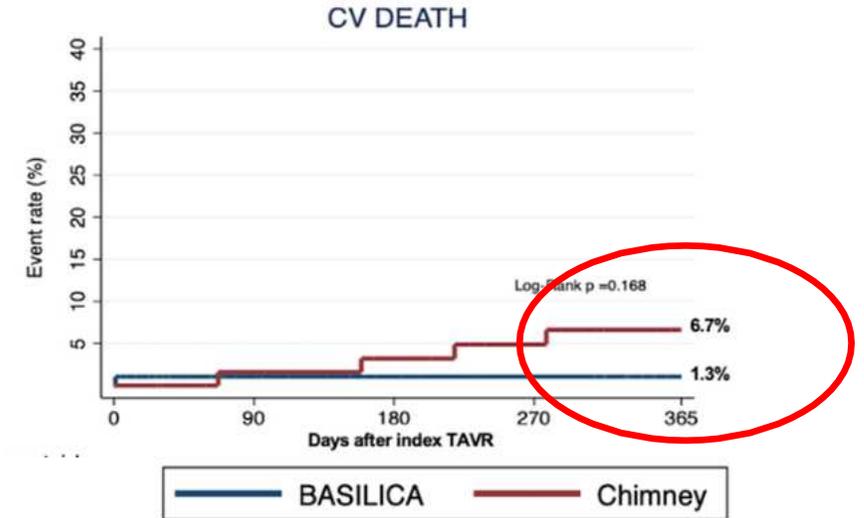


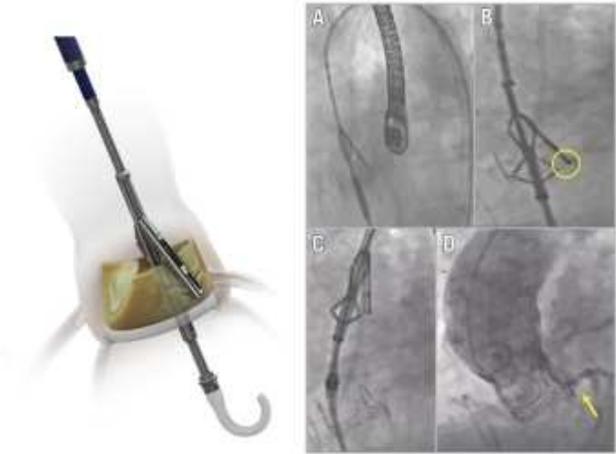
TABLE 3 Procedural Data

	Chimney (n = 71)	BASILICA (n = 97)	Overall (N = 168)	P Value
TAVR main approach				0.24
Transfemoral	70 (98.6)	97 (100.0)	167 (99.4)	
Transapical	1 (1.4)	0 (0.00)	1 (0.6)	
Contrast volume, mL	195.6 ± 94.5	132.1 ± 94.1	158.1 ± 99.0	<0.001
Procedural length, skin-to-skin time, min	148.69 ± 51.1	146.2 ± 77.3	147.1 ± 69.0	0.84
TAVR prosthesis type				0.80
Self-expanding	61 (85.9)	82 (84.5)	129 (83.7)	
Balloon-expandable	10 (14.1)	15 (18.1)	25 (16.2)	

Dual leaflet 230 min +/- 90

Short Cup : étude pilote

- 60 patients, efficacité 100 %, matériel dédié
- 1 AVC / aucun décès per procédure
- 3 patients ont requis une revascularisation coronaire: succès à chaque fois avec angioplastie en bonne position
- Utilisation du device pour la première fois par de nombreux opérateurs : simple et efficace



Risk of aortic root anatomy for coronary obstruction^a

VIVID type I/IIA/IIIA (low risk)	0 (0)
VIVID type IIB (high risk)	35 (43)
VIVID type IIIB (high risk)	32 (39)
VIVID type IIIC (high risk)	15 (18)

Failed valve type

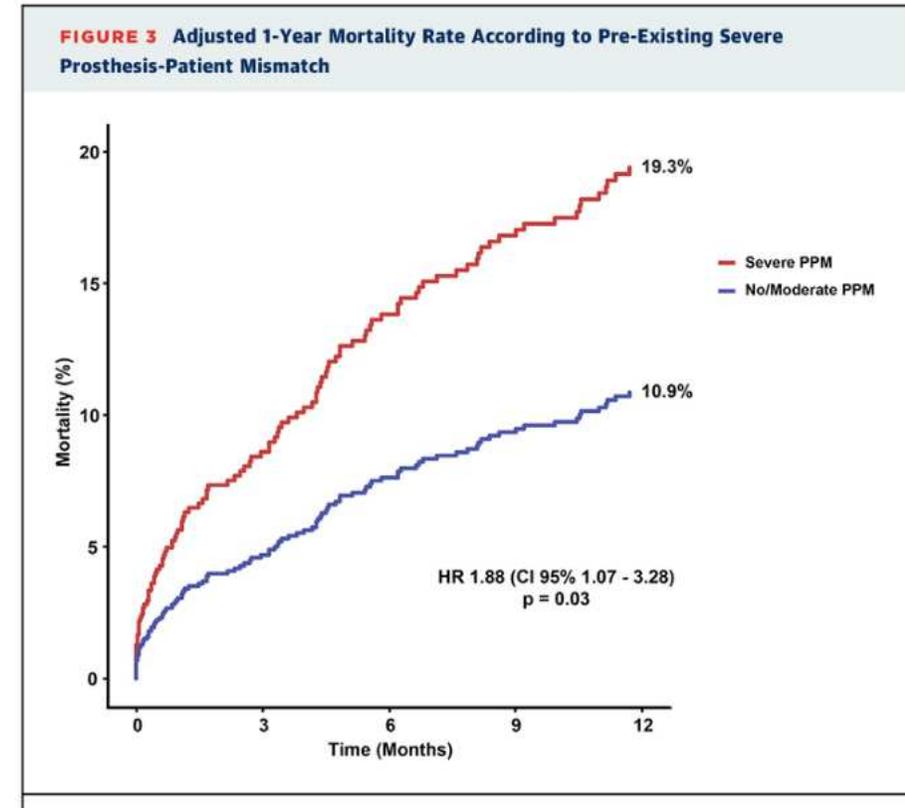
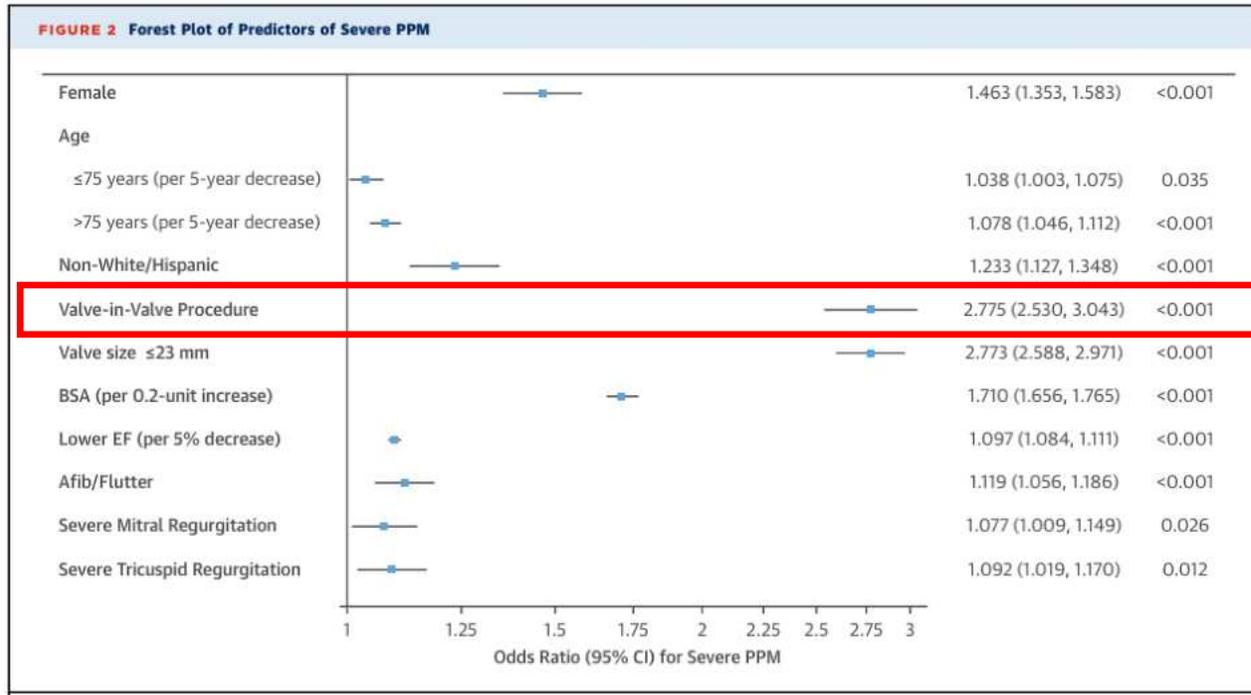
SAVR	58 (96.7)
Stented, internally mounted	29 (48.3)
Stented, externally mounted	25 (41.7)
Stentless	4 (6.7)
TAVI	2 (3.3)

ShortCut procedure time including split verification by TEE, min ^a	30.6 ± 17.9
Single split, min	26.9 ± 19.7
Dual split, min	37.0 ± 14.7

Mismatch

Registre VIVID 1168 patients VIVA

Registre STS/ACC 62 125 patients pris en charge par TAVI



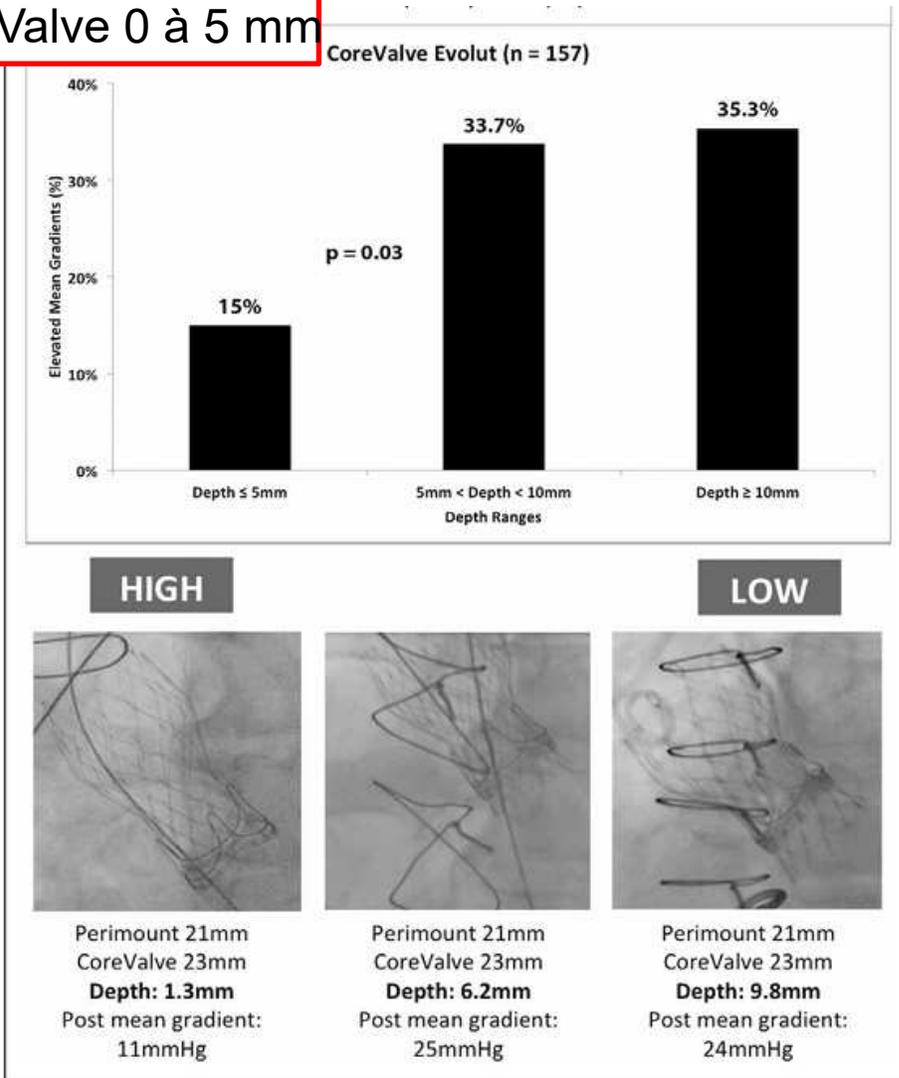
Hermann HC et al, J Am Coll Cardiol 2018;72:2701-11

Pibarot et al, J Am Coll Cardiol Intv 2018;11:133-41

Prévention du Mismatch

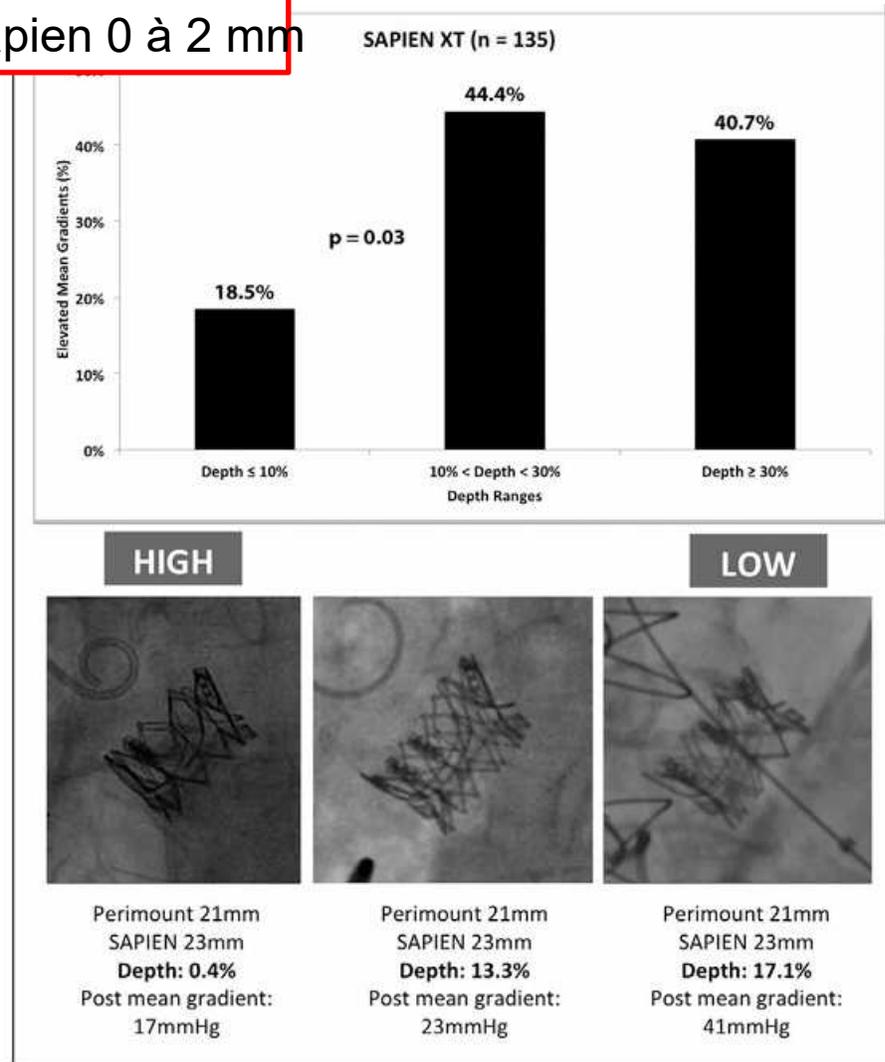
Hauteur d'implantation

CoreValve 0 à 5 mm



Données cliniques et sur banc d'essai

Sapien 0 à 2 mm



Prévention du Mismatch

Donnée randomisée SEV vs BEV

Bioprothèse chirurgicale de petite taille ≤ 23 mm

TABLE 3 30-Day Clinical and Echocardiographic Outcomes

	BEV (n = 45)	SEV (n = 52)	P Value
Antithrombotic treatment	45	52	
Aspirin therapy	31 (69)	33 (63)	0.76
Clopidogrel therapy	18 (40)	25 (48)	0.43
Anticoagulation therapy	10 (22)	15 (29)	0.43
Clinical outcomes	45	52	
Death	0 (0)	0 (0)	—
Stroke	0 (0)	0 (0)	—
Myocardial infarction	0 (0)	1 (2)	0.34
Life threatening/major bleeding	1 (2)	0 (0)	0.47
Major vascular complication	1 (2)	0 (0)	0.47
Permanent pacemaker	0 (0)	0 (0)	—
Echocardiographic outcomes (echocardiography core laboratory analyses, n = 97)	45	52	
LVEF, %	56 ± 12	57 ± 12	0.68
Mean aortic gradient, mm Hg	23 ± 8	15 ± 8	<0.001
Mean gradient >20 mm Hg	28 (62)	11 (21)	<0.001
Maximal aortic gradient, mm Hg	40 ± 13	28 ± 16	<0.001
Effective orifice area, cm ²	1.23 ± 0.46	1.36 ± 0.46	0.17
Effective orifice area indexed, cm ² /m ²	0.65 ± 0.24	0.77 ± 0.28	0.04
Velocity ratio	0.30 ± 0.10	0.36 ± 0.11	0.01
Moderate/severe PPM (severe) VARC-2 ^b	28/44 (64)	20/45 (44)	0.07
PPM (severe) VARC-3	17/44 (39)	9/45 (20)	0.053

Effective orifice area indexed, cm²/m²

0.65 ± 0.24

0.77 ± 0.28

0.04

Prévention Mismatch : Fracture de bioprothèse

- Mismatch préexistant ou anticipé (prothèse petite taille)
- Planification de la procédure +++
 - valve fracturable ? (ex St Jude Trifecta, non fracturable)
 - ballon non compliant (ex Atlas), 1 à 3 mm au dessus du ID
 - adéquation taille valve percutanée / ballon NC



Fracture de bioprothèse

Peu de complication

89 % BVF après le TAVI-ViV

Table 3. Complications in-hospital for VIV-TAVI with BVF versus without BVF.

	BVF (N=81)	Control (N=79)	p-value
Device success, %	93 (75)	68 (54)	<0.001
Prosthesis failure, %*	6 (5)	28 (22)	
2 nd valve required, %	0 (0)	4 (3)	
In-hospital mortality, % ⁺	1 (1)	3 (2)	
Ventricular septal rupture, %	3 (2)	(0)	
Aortic root rupture, %	0 (0)	(0)	
All stroke, %	0 (0)	3 (2)	
Coronary obstruction, %	0 (0)	3 (2)	
Balloon rupture, %	0 (0)	(0)	
Cardiac tamponade, %	0 (0)	(0)	
Permanent pacemaker, %	1 (1)	3 (2)	

*due to residual gradient ≥ 20 mmHg. +BVF: retroperitoneal bleeding after balloon rupture in iliac artery. Control: one patient due to severe cardiomyopathy, one patient due to coronary obstruction at day 3.

Fracture de bioprothèse : Timing

Fracture : post TAVI +++

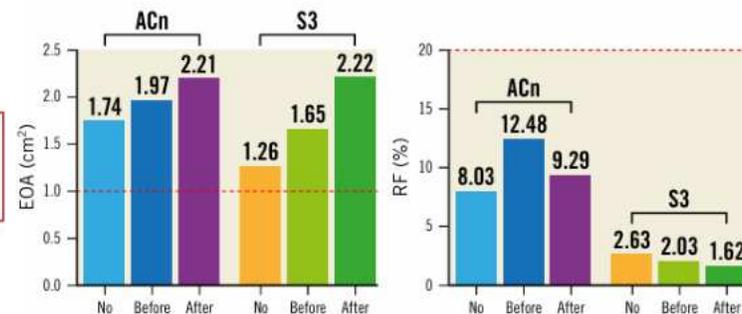
Table 2. THV dimensions by BVF timing for ViV with the 23 mm S3, small ACn and 23 mm Evolut R in 21 mm Mitroflow bioprotheses.

	No BVF	BVF before ViV	BVF after ViV
SAPIEN 3			
Inflow	16.8 mm	18.4 mm	21.8 mm
Mid-valve	17.1 mm	17.7 mm	22.3 mm
Outflow	21.5 mm	20.7 mm	22.8 mm
ACURATE neo			
Inflow	15.5 mm	17.2 mm	17.6 mm
Leaflet nadir	17.9 mm	20.9 mm	21.9 mm
Evolut R			
Inflow	15.3 mm	16.6 mm	18.5 mm
Leaflet nadir	18.3 mm	18.2 mm	19.7 mm

	No BVF	BVF before ViV	BVF after ViV
SAPIEN 3	8.8 %	7.7 %	0.8 %
ACURATE neo	6.6 %	5.1 %	3.5 %
Evolut R	7.3 %	6.6 %	3.7 %

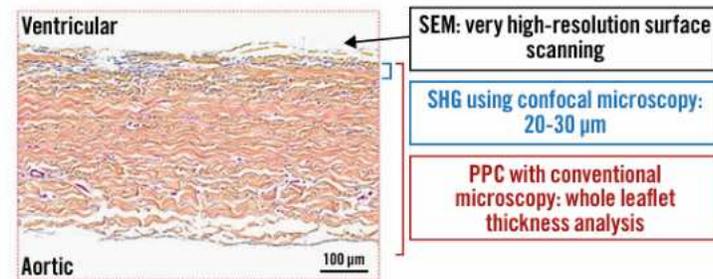
Figure 4. Pinwheeling index (%) by BVF timing for ViV with the 23 mm S3, small ACn and 23 mm Evolut R in 21 mm Mitroflow bioprotheses.

Hydrodynamic testing at baseline and after AWT up to 200M cycles (equivalent to 5 years)



BVF performed after ViV is associated with larger EOA without increase in RF

Multimodality assessment of ultrastructure at different depth of the leaflets



BVF after ViV is associated with more superficial damage (SEM and SHG) but with a more preserved overall ultrastructure as demonstrated by PPC

Meir D et al, EuroIntervention 2023;18:1165-1177

Sathananthan J et al, EuroIntervention 2020;15:1409-1416

Malposition / fuite para-prothétique

Valve chirurgicale stentless

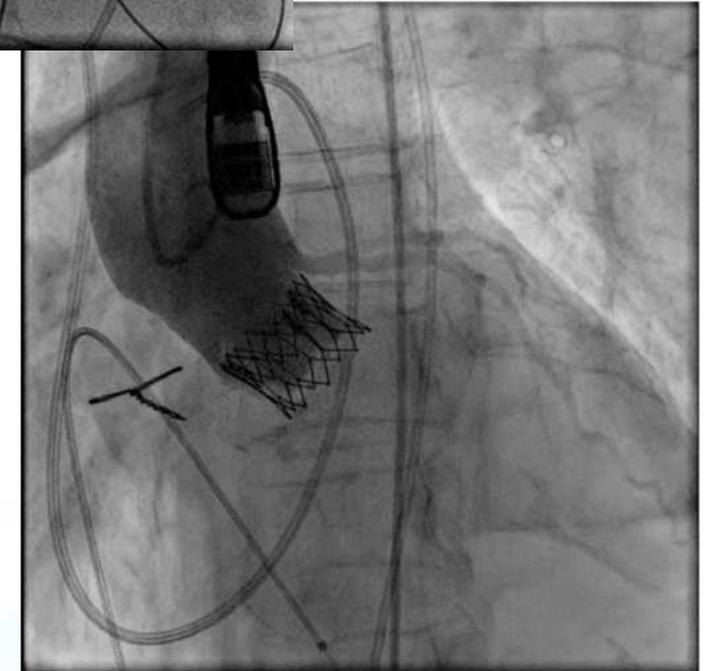
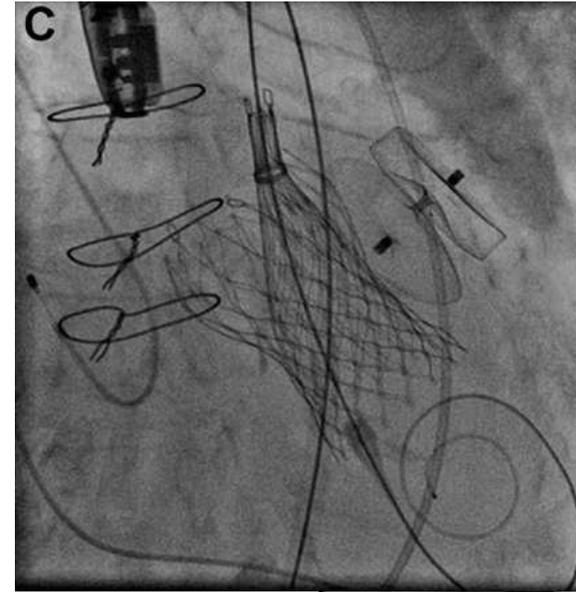
Registre VIVID, 1598 patients : 291 stentless vs 1307 stented

Valve stentless :

- Dégénérescence fuyante : encrage difficile
- Pas de marqueur radio scopique : plus difficile à poser
 - Plus de fuites para-prothétiques (11 % vs 4,5 % au moins modérée)
 - Plus de recours à une 2^{ème} prothèse (7,9 % vs 3,4%)
 - Plus d'obstruction coronaire (6 % vs 1,5%)

Prévention

- 2 pigtails pour le repérage de l'anneau
- Oversizing et posdilatation
- BEV, SEV ?



Thrombose de valve

Registre VIVID 300 patients

- Incidence de thrombose clinique de valve : 7,6 %, délai médian 101 jours, la grande majorité dans l'année.

Facteur favorisant

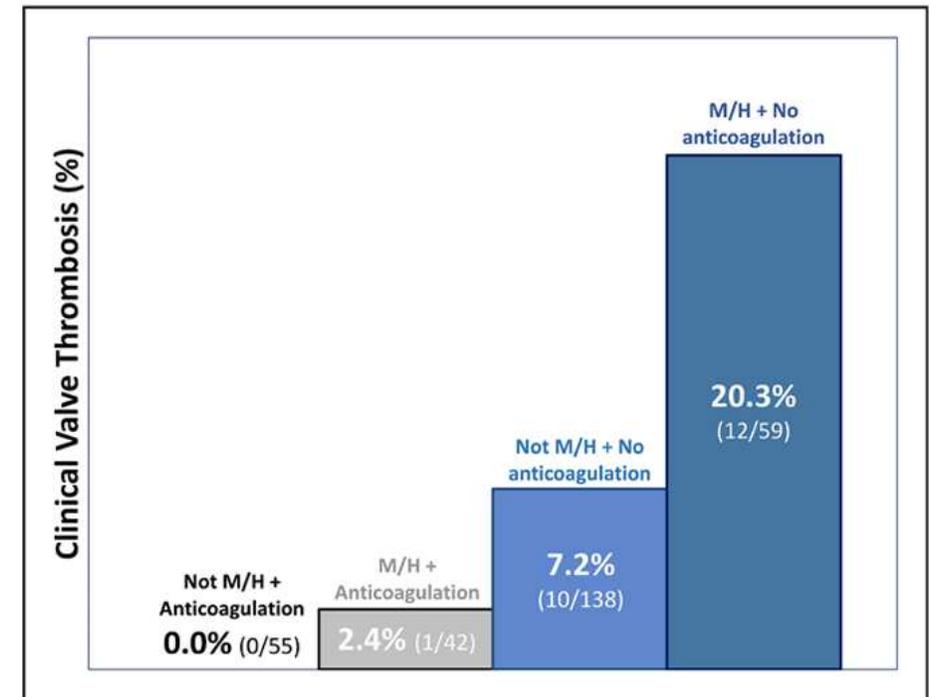
- Ratio ID/BSA bas
- Valve Mosaic et Hancock II +++

Facteur protecteur

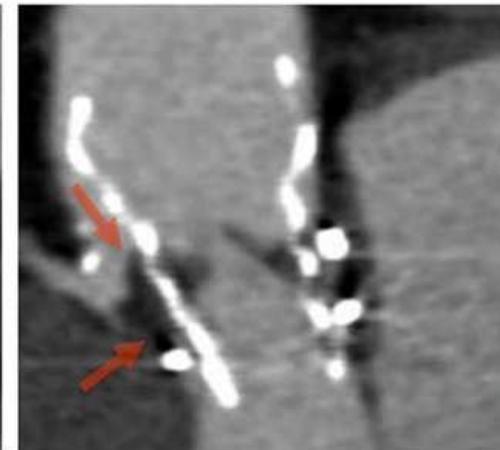
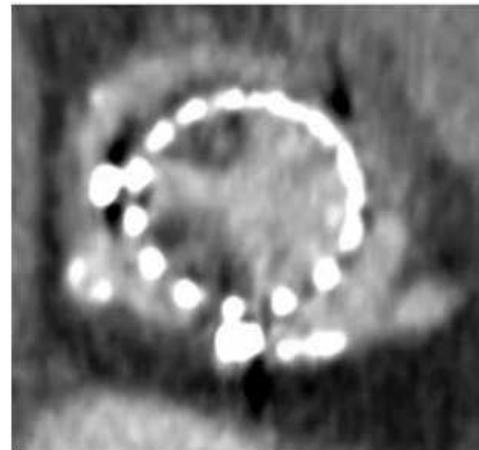
- ACO

Prévention

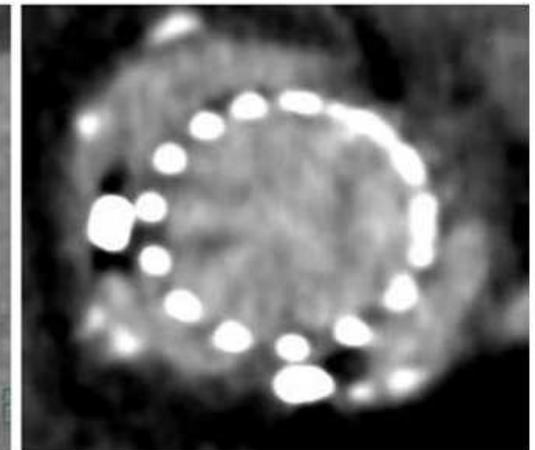
- Alignement commissural
- ACO post procédure au cas par cas
- Contrôle scanner systématique ?



At the time of CVT diagnosis



After 1 month of VKA



Conclusion ViVA

- **Nombreuses particularités de la procédure**
- **Importance de la planification de la procédure et du suivi**
- **Discussion Heart team**
 - **Risque opératoire**
 - **Anatomie du patient**
- **La chirurgie cardiaque redux a toute sa place**

Merci !