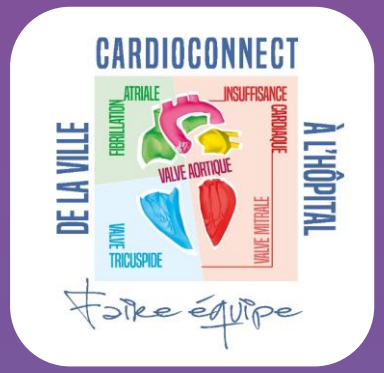
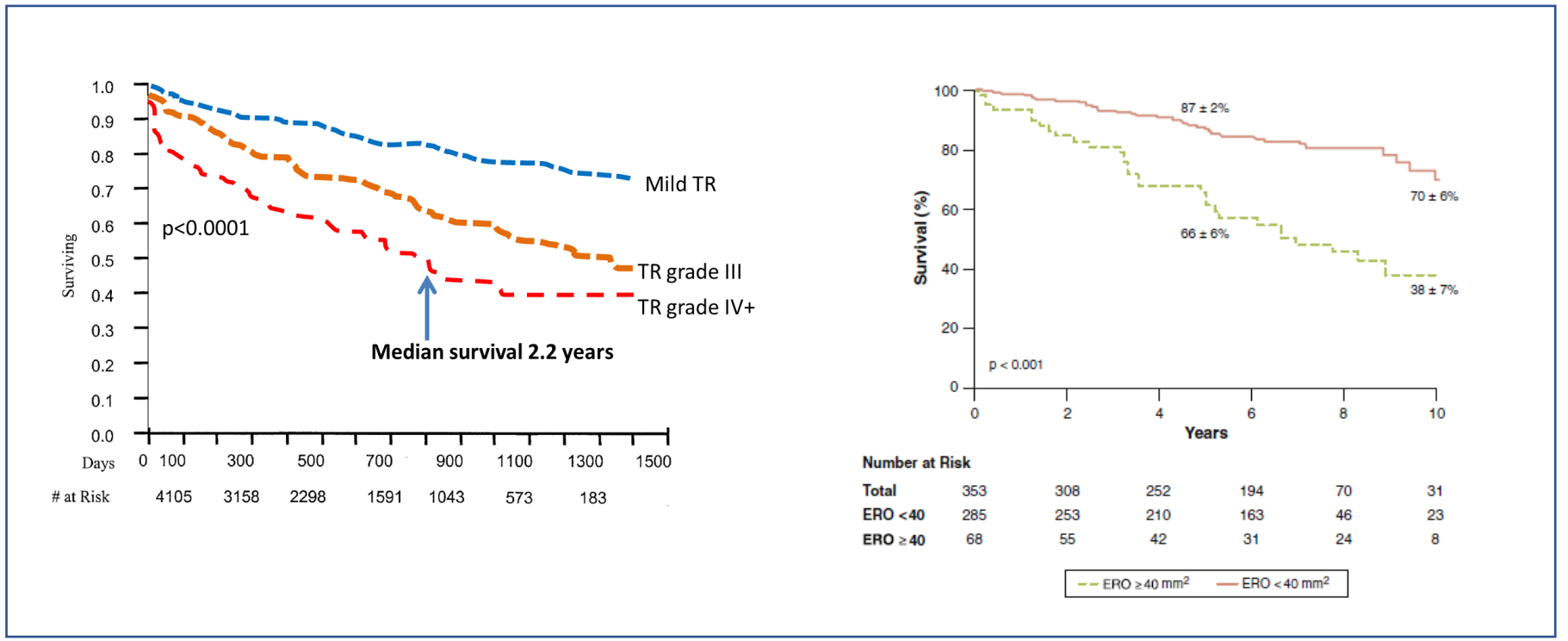
Traitement percutané des valves tricuspides : réparation ou remplacement ?

Dr Romain GALLET, Pr Emmanuel TEIGER

CHU Henri Mondor, APHP, Créteil

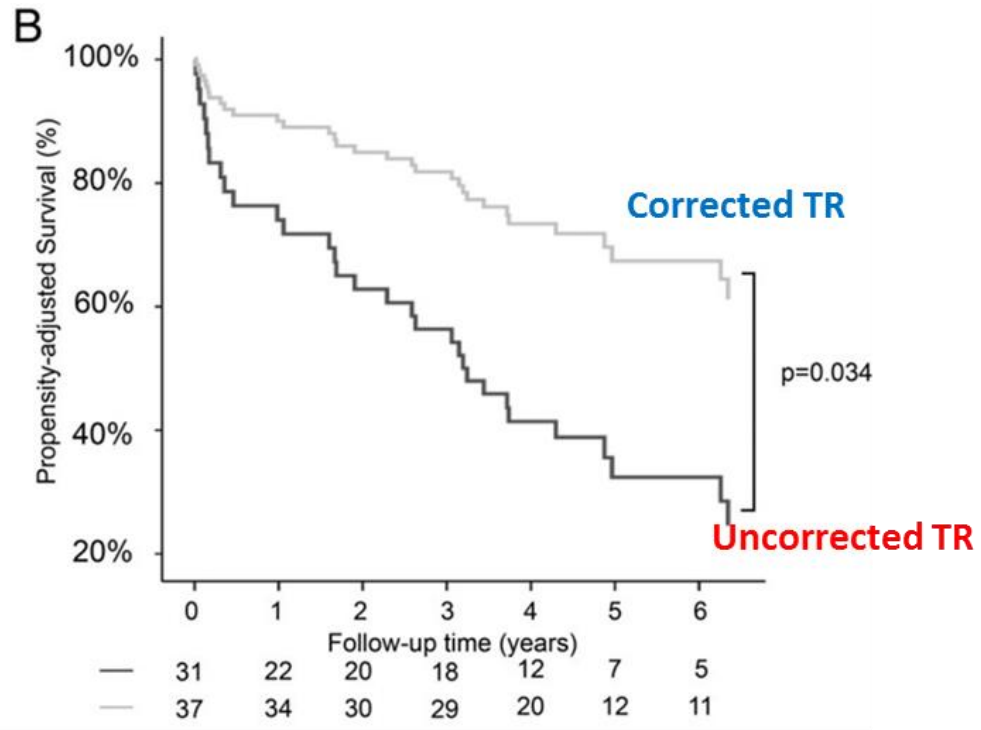


Pronostic en cas d'IT ?



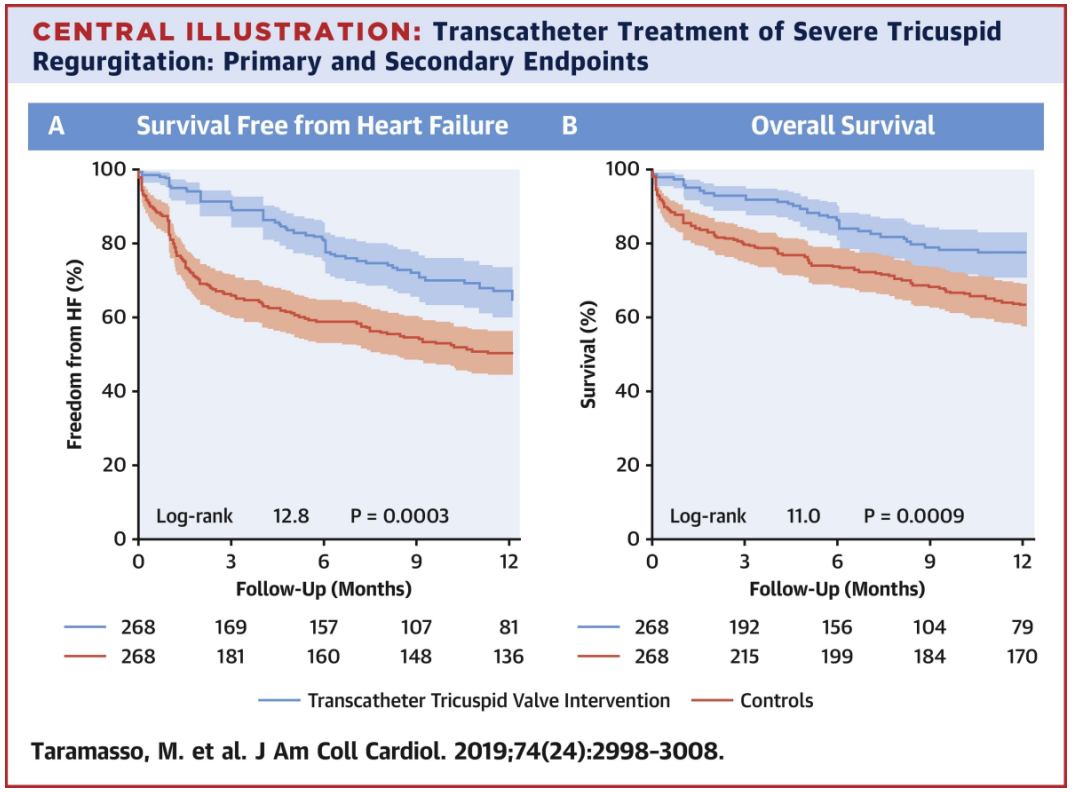
- ❑ Le pronostic de la fuite tricuspide sous traitement médical dépend de sa sévérité
- ❑ La SOR ≥40mm² a été validée comme un critère pronostic indépendant dans les IT isolées
- ❑ La médiane de survie est 2 à 6 ans selon l'étiologie de la fuite.

Faut –il corriger les IT?



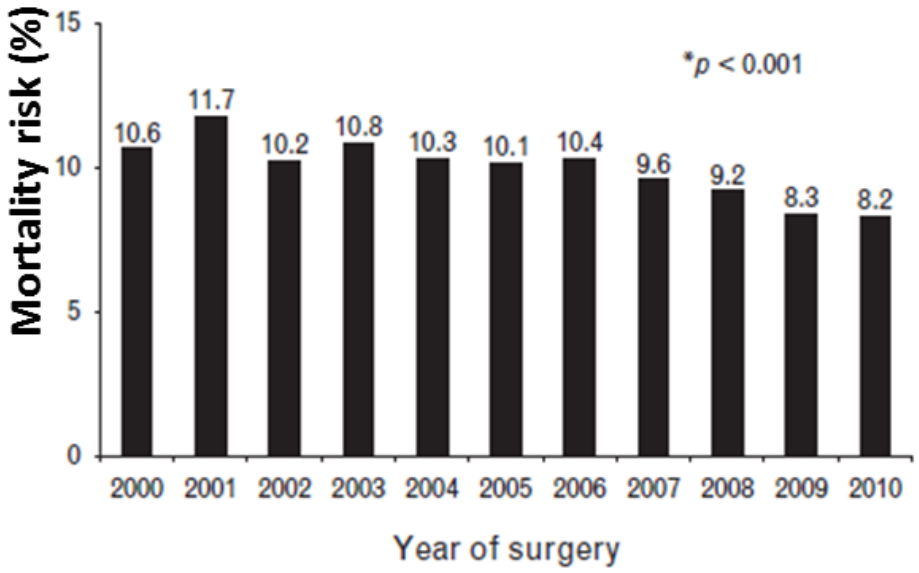
Rogers Curr Opin Cardiol 2014

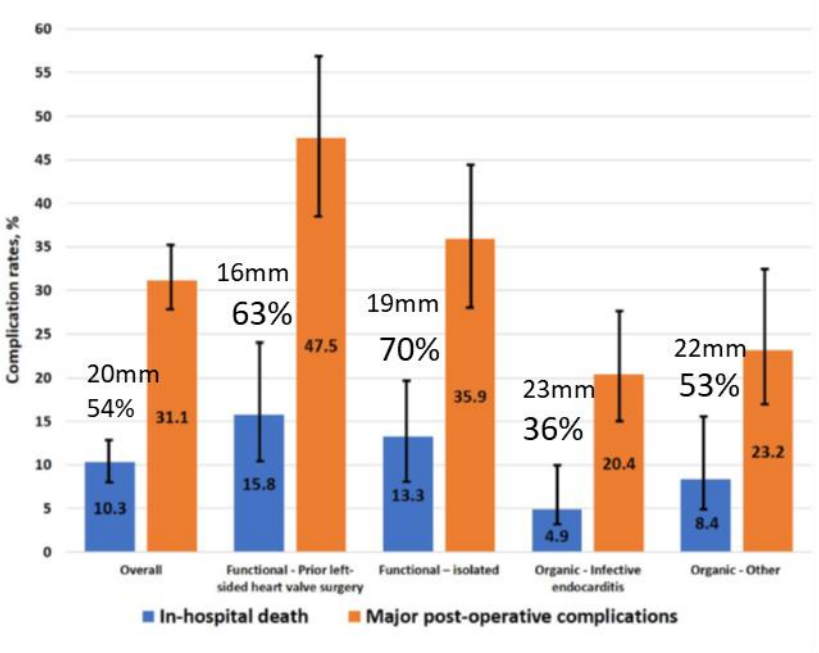
Transcatheter Versus Medical Treatment of Patients With Symptomatic Severe Tricuspid Regurgitation



Maurizio Taramasso, J Am Coll Cardiol 2019

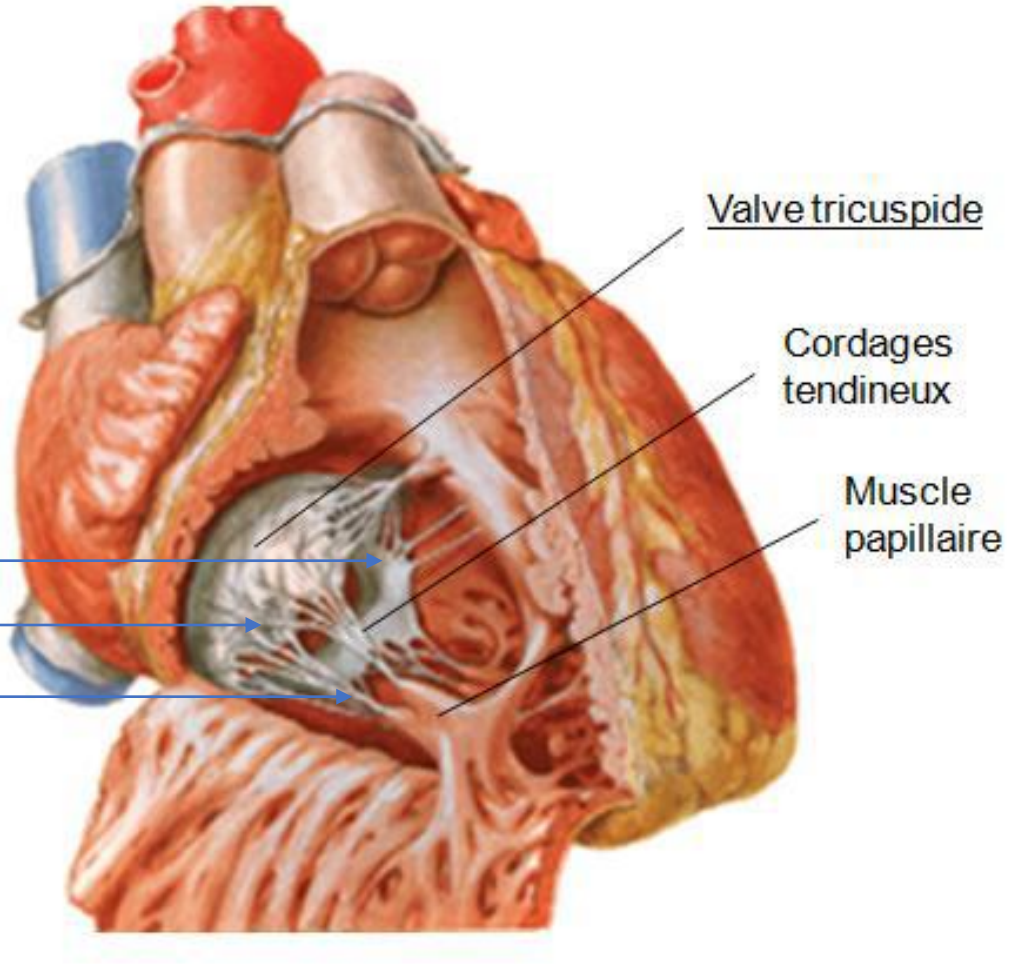
Risque opératoire





- La mortalité est d'environ 10% lorsque l'on inclut les fuites organiques et fonctionnelles
- Dans les fuites fonctionnelles pures, la mortalité est plutôt de 13 à 16%

Réparer ou remplacer?



<u>3 feuillets</u>

- Septal
- Antérieur
- Postérieur

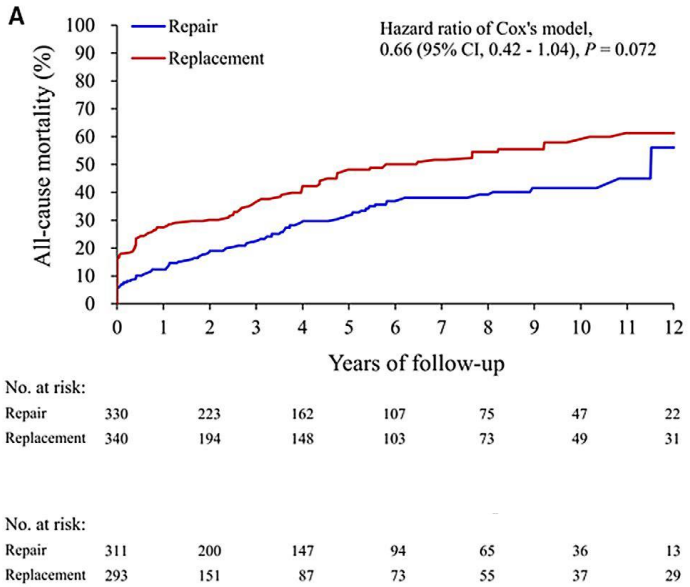
❑ 3 feuillets

❑ Nombreux cordages

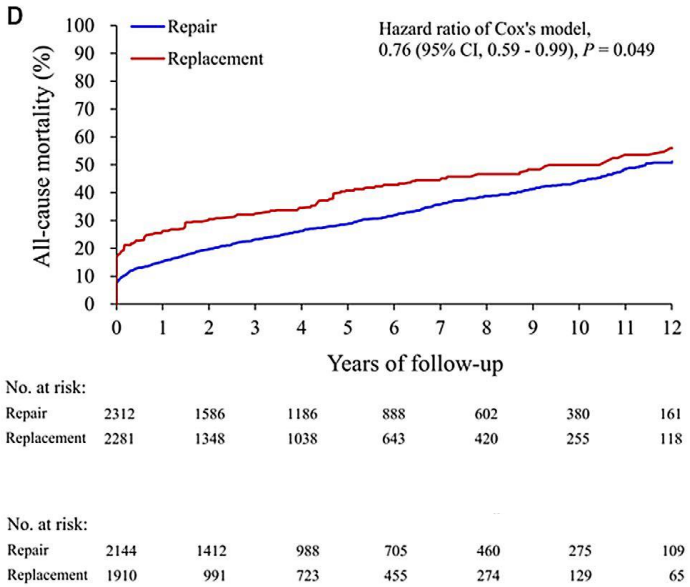
→ complique potentiellement la réparation

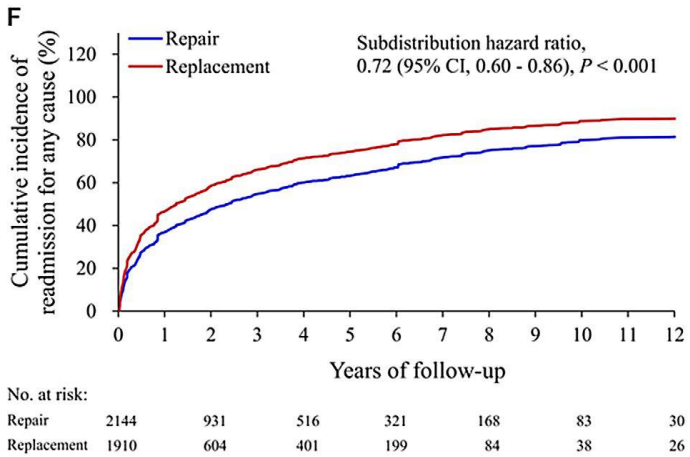
Les leçons de la chirurgie

Isolated tricuspide surgery



Concomitant tricuspide surgery





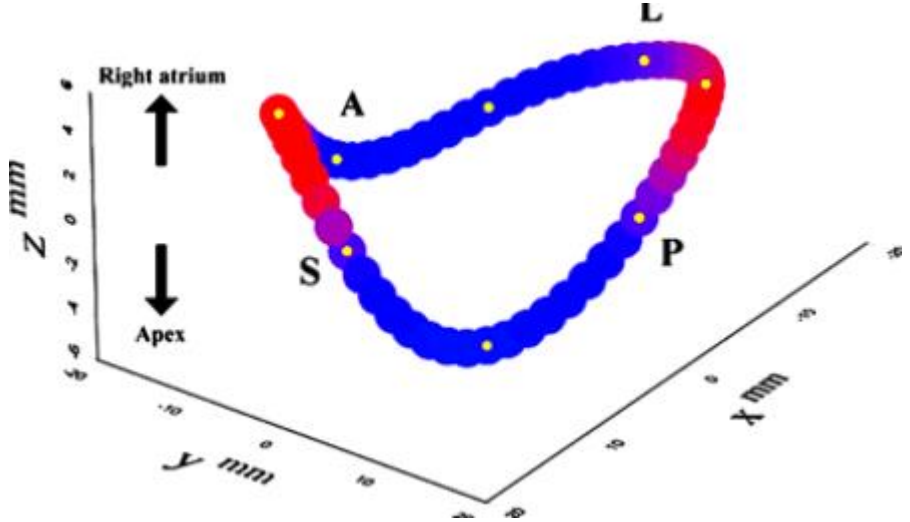
Journal of the American Heart Association **2020**

ORIGINAL RESEARCH

Late Outcomes of Valve Repair Versus Replacement in Isolated and Concomitant Tricuspid Valve Surgery: A Nationwide Cohort Study

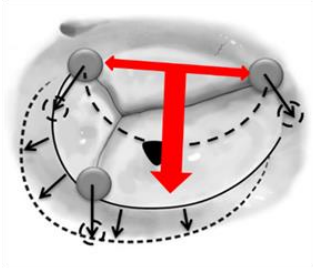
Wang-Kin Wong, BDS, MD*; Shao-Wei Chen, MD, PhD*; An-Hsun Chou, MD, PhD; Hsiu-An Lee, MD; Yu-Ting Cheng, MD; Feng-Chun Tsai, MD; Kuang-Tso Lee, MD; Victor Chien-Chia Wu, MD; Chun-Li Wang, MD; Shang-Hung Chang, MD, PhD; Pao-Hsien Chu, MD

Réparer ou remplacer?

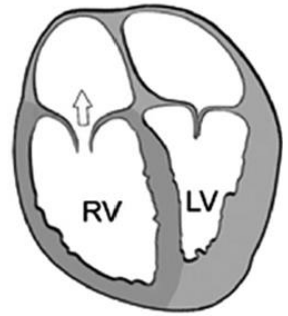


Diamètre <40mm ou <21mm/m²
Normal=28±5mm²
Surface =8cm²
Variation de surface 30%

1- Dilatation de l'anneau



2- Dilatation du VD



- ❑ Anneau en forme de selle de cheval
- ❑ Variation au cours du cycle cardiaque
- ❑ Dilatation importante anneau et VD
- ❑ Pas de « landing zone évidente, pas de calcifications

→ complique potentiellement le remplacement

Différentes possibilités

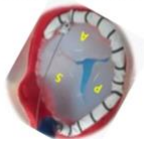
EFS → CE-marked

Annuloplasty

TriCinch

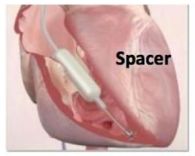
Trialign

Cardioband

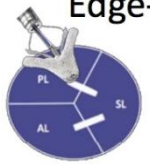


Coaptation

Forma



Edge-to-Edge

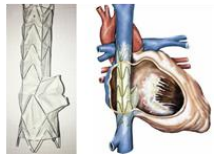


Clip

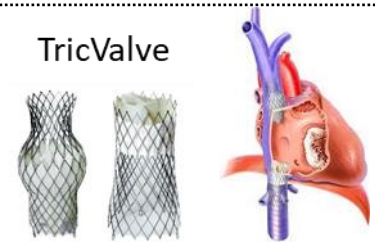
Pascal

Heterotopic

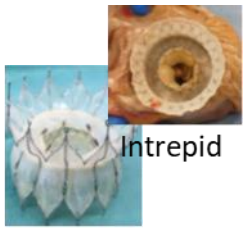
Tricento



TricValve



Replacement



Intrepid

Tricares

Lux

Navigate

Evoque

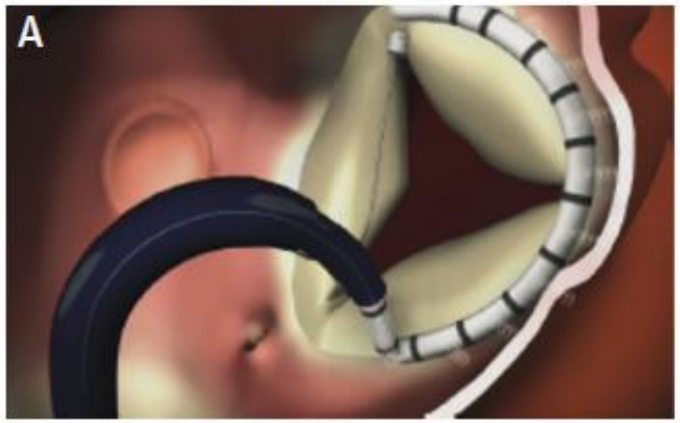
Différentes possibilités

EFS → CE-marked

Annuloplasty	TriCinch ✗	Trialign ✗	Cardioband ✓
Coaptation	Forma ✗	Edge-to-Edge: Clip	Pascal ✓
Heterotopic	Tricento ✗	TricValve	
Replacement	Navigate, Intrepid, Lux, Tricares, Evoque		

Annuloplasty: cardioband

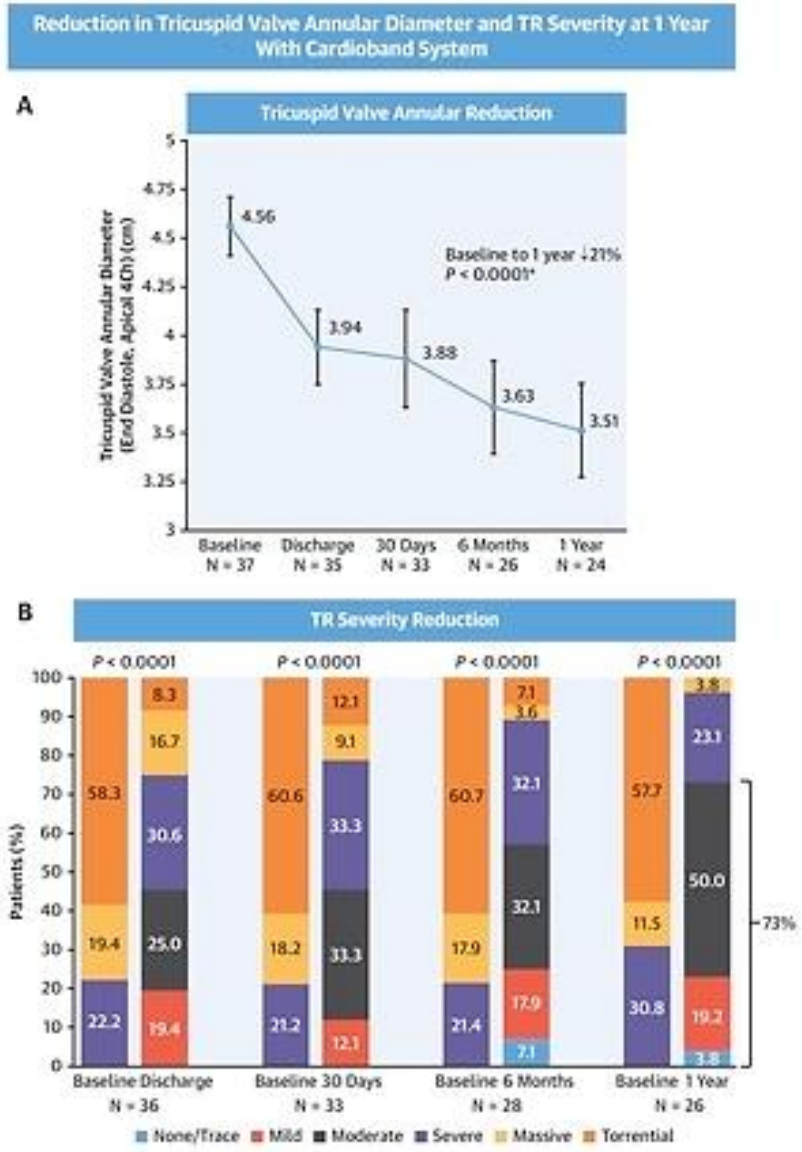
Cardioband Anchor Deployment



Population: IT fonctionnelle sévère (EROA=0.79±0.51mm²)

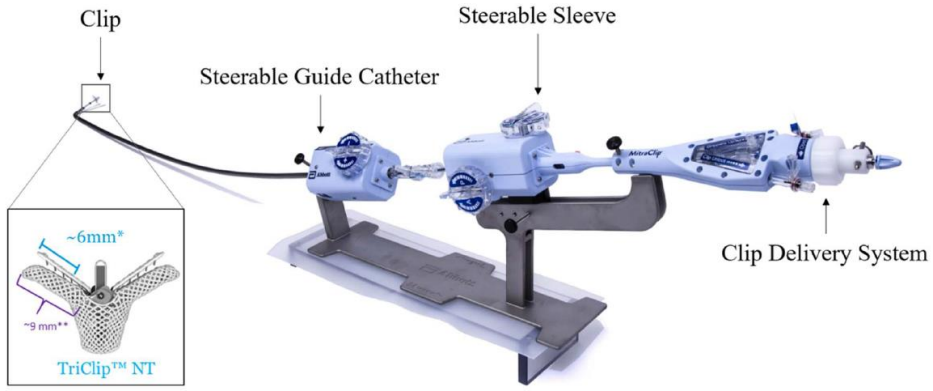
Résultats: Succès d'implantation 100%, mortalité péri-procédure: 6,7%
Amélioration clinique (82% vs. 17% en classe NYHA II à 2 ans)

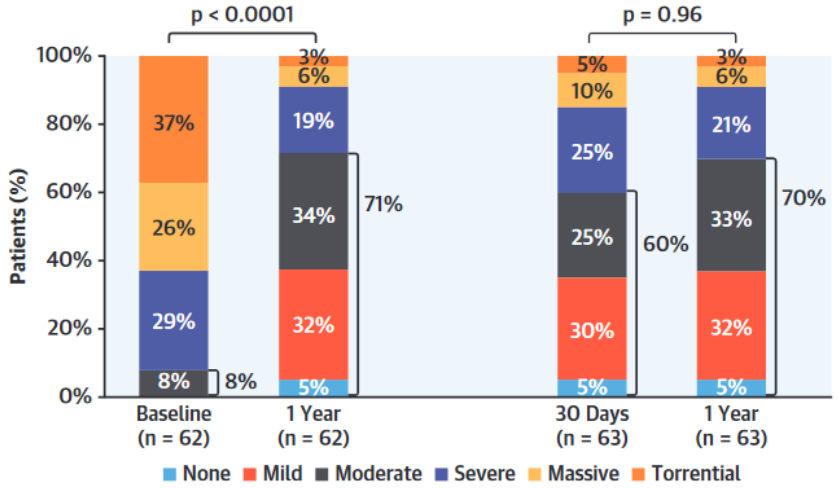
Limites
Durée de procédure : **4,2±1,5 heures** (16 vis en moyenne) - ETO+++
Efficacité modérée sur la fuite [**24% grade ≤II,** à 1 an]



Gray WA, et al. J Am Coll Cardiol Intv. 2022;15(19):1921-1932.

Réparation bord à bord: triclip

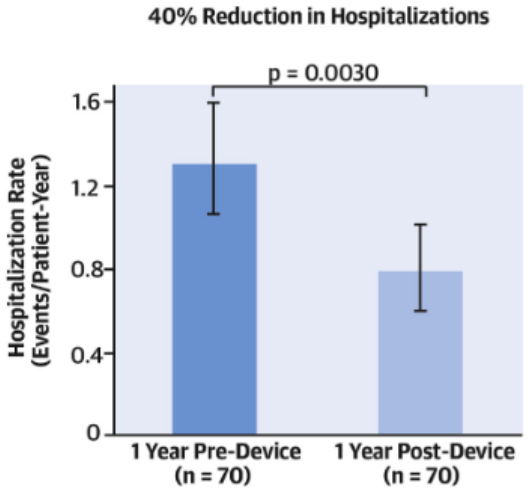




Population: N=85 patients IT fonctionnelle modérée à sévère (EROA=0.65±0.29 mm²)

Résultats: 5% de mortalité à 1 mois (non liée à la procédure) 90% Succès implantation –
Amélioration clinique soutenue (80% vs. 25% en classe NYHA I-II à 1 mois et un an)

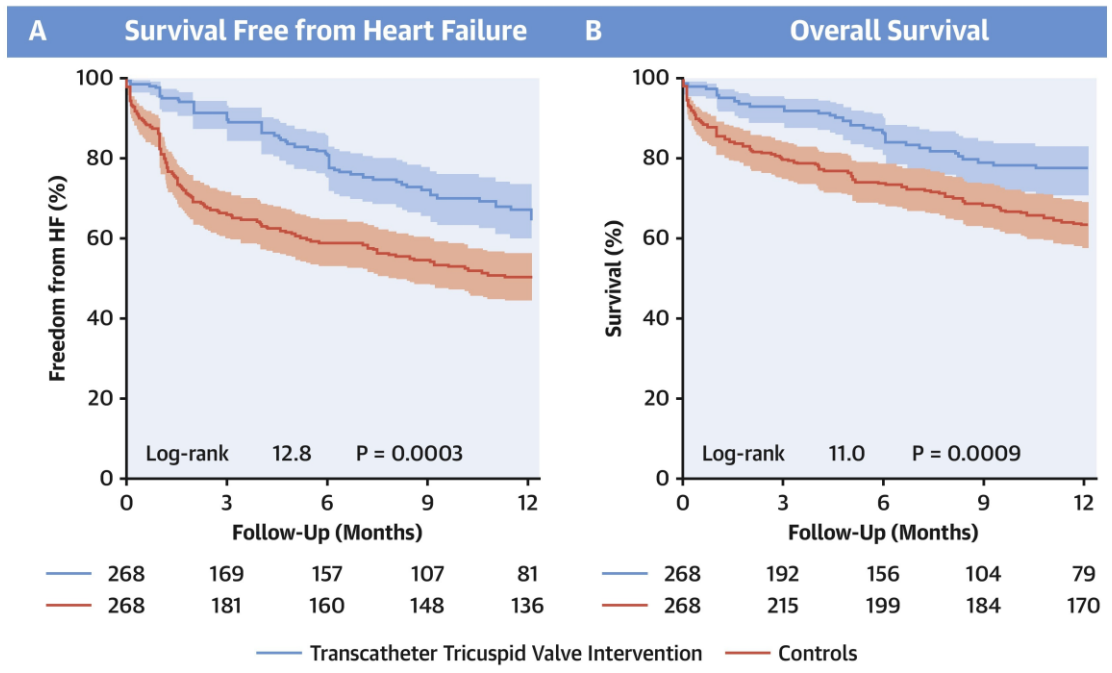
Limites
Durée de procédure : 2,6±1 heures (67% 1-2 clips -77% sur la commissure AS)
Qualité imagerie ETO +++
Efficacité modérée sur la fuite [37% grade ≤II, 70% ≤3]



Réparation bord à bord: clip

Transcatheter Versus Medical Treatment of Patients With Symptomatic Severe Tricuspid Regurgitation

CENTRAL ILLUSTRATION: Transcatheter Treatment of Severe Tricuspid Regurgitation: Primary and Secondary Endpoints

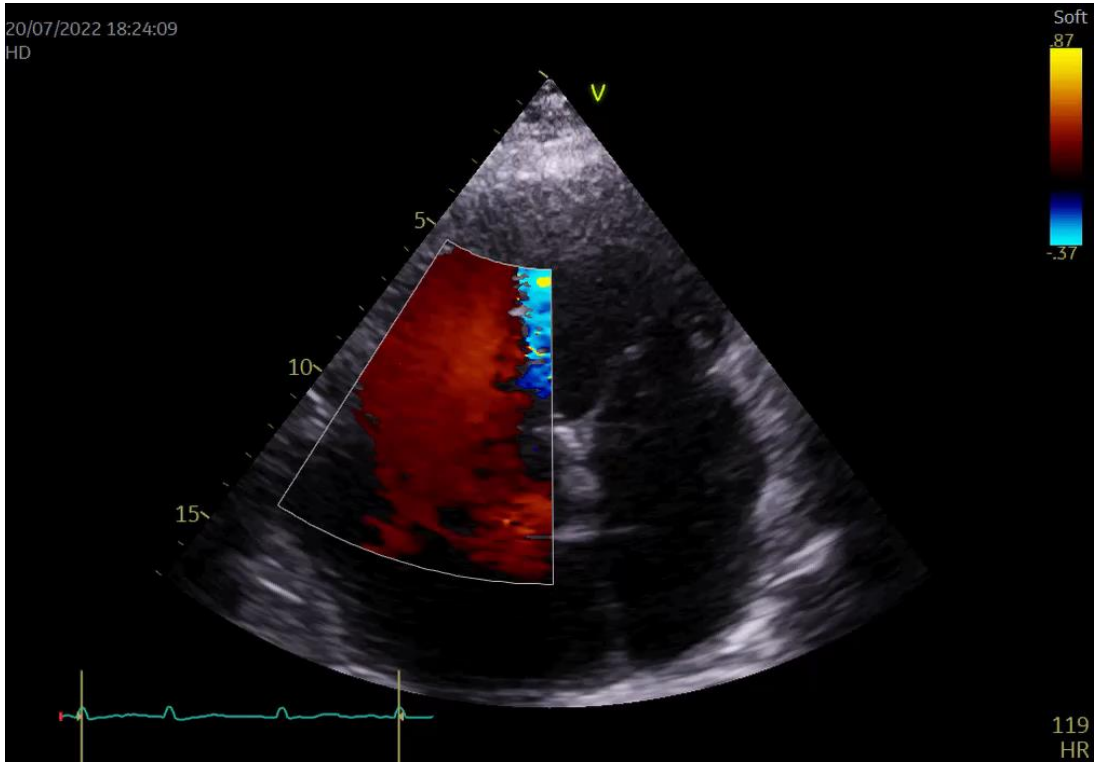


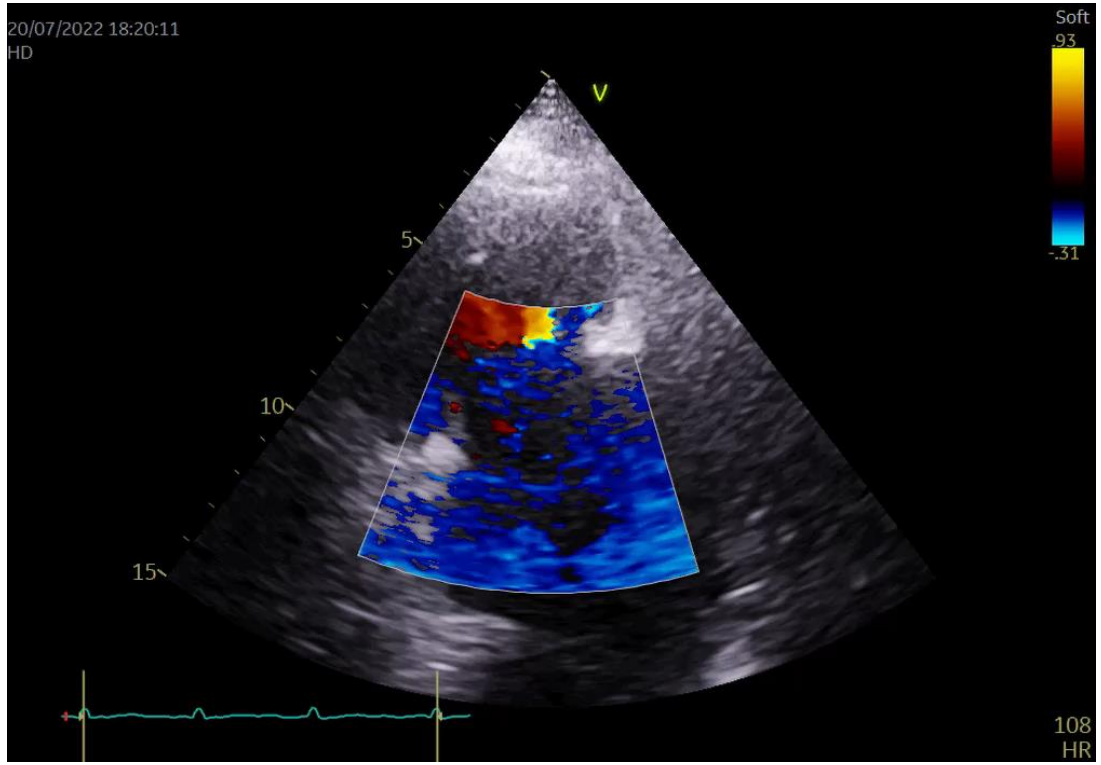
Taramasso, M. et al. J Am Coll Cardiol. 2019;74(24):2998-3008.

Registre TTVR vs. contrôles appariés
229/268 mitraclip (85%)

Réparation bord à bord: clip

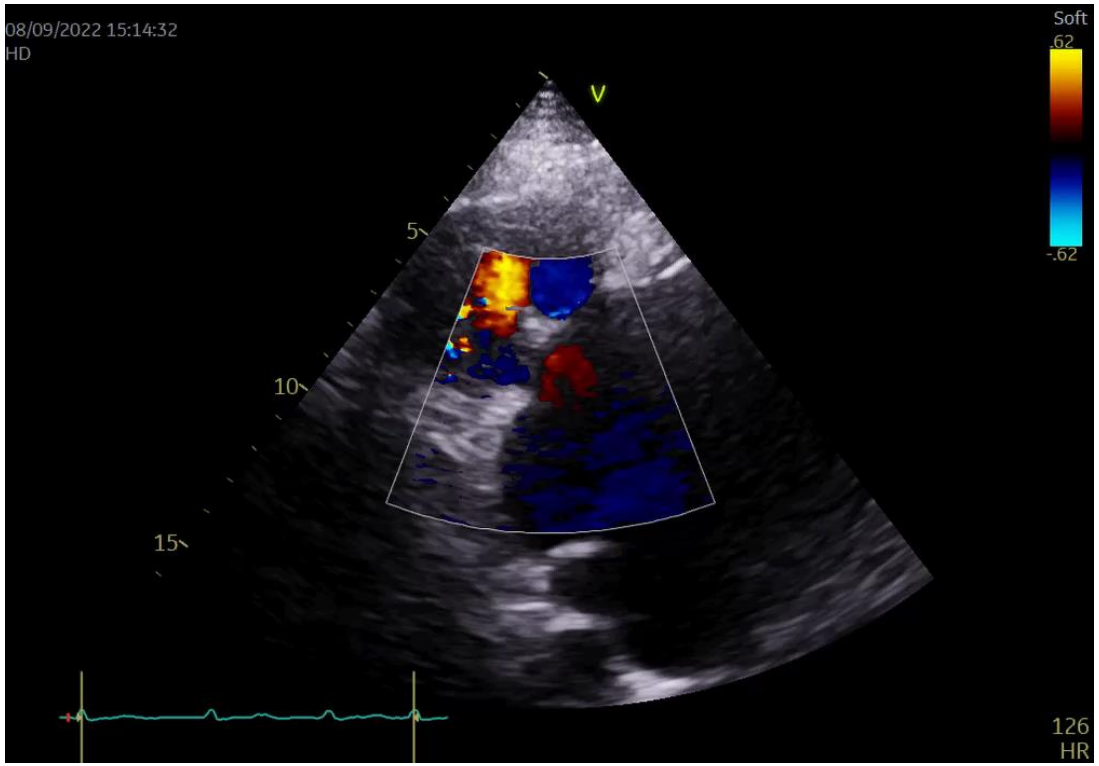
Femme 75 ans
FA permanente depuis 2010
Cardiopathie rythmique avec dilatation majeure de l'OD et fuite tricuspide torrentielle
Décision de réparation percutanée par Mitraclip

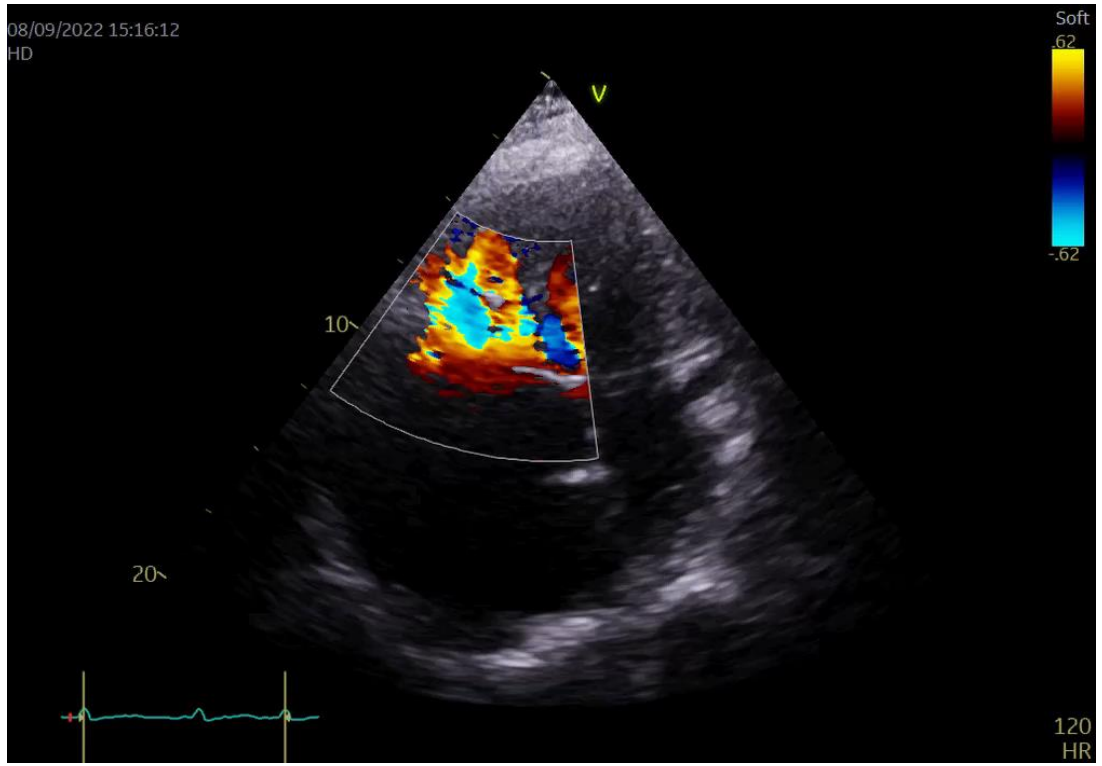




Réparation bord à bord: clip

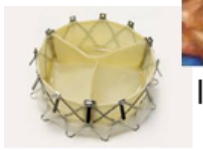
Après 2 mitraclips implantés en position tricuspide entre les feuillets antérieur et septal



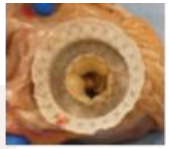


Différentes possibilités

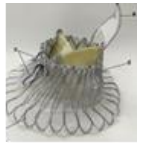
Remplacement



Navigate



Intrepid



Lux

Tricares

Evoque

EVOQUE (EDWARDS)

A

B

Deux tailles 44mm (32%) 48 (64%) mm

28F – femoral access

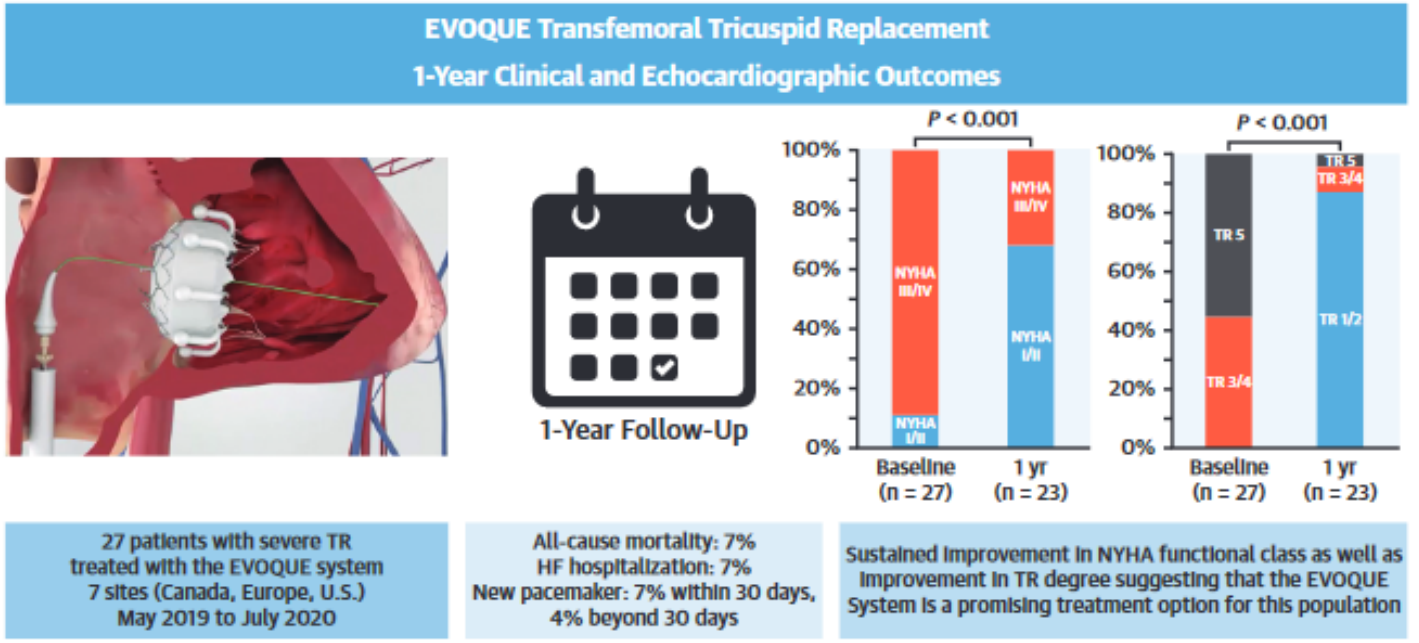
Résultats: 92% Succès implantation **– 0% de mortalité péri-procédure**
Amélioration clinique (76% vs.4% en classe NYHA I-II à 1 mois)
Efficacité sur la fuite [92% grade ≤I]

Limites
Durée de procédure : 2,3±2,5 heures
8% de BAV III
Taille des prothèses

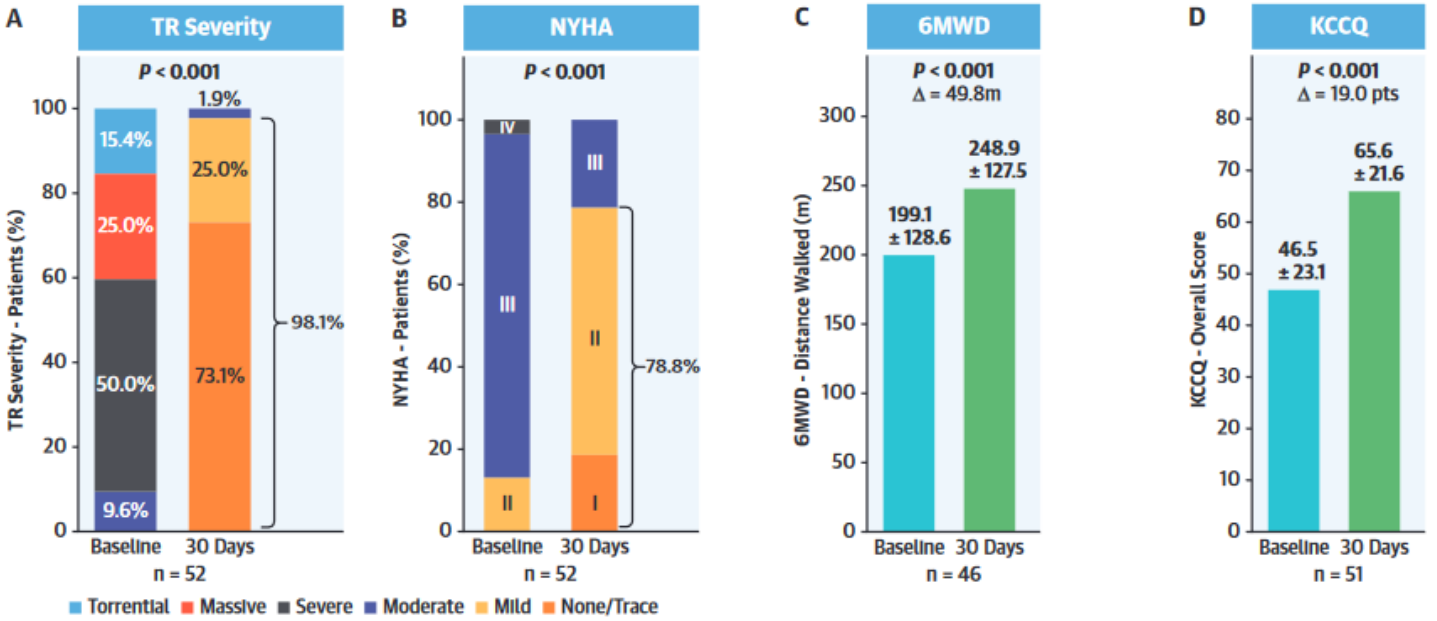
TABLE 4 Clinical Events Committee–Adjudicated Safety Events at 30 Days (N = 56)

Cardiovascular mortality	1 (1.8)[a]
Myocardial infarction	0
Stroke	0
Renal complications requiring dialysis or renal replacement therapy	0
New need for renal replacement therapy	0
Severe bleeding[b]	15 (26.8)
Fatal	0
Life-threatening	0
Extensive	7 (12.5)
Major	8 (14.3)
Nonelective tricuspid valve reintervention	2 (3.6)
Major access site and vascular complications requiring intervention	1 (1.8)
Major cardiac structural complications	0
Device-related pulmonary embolism	0
Composite MAE rate	15 (26.8)

EVOQUE



Webb, J.G. et al. J Am Coll Cardiol Intv. 2022;15(5):481–491.



Kodali et . al TRISCEND Study, JACC CI 2022

LuX-Valve: 1-month

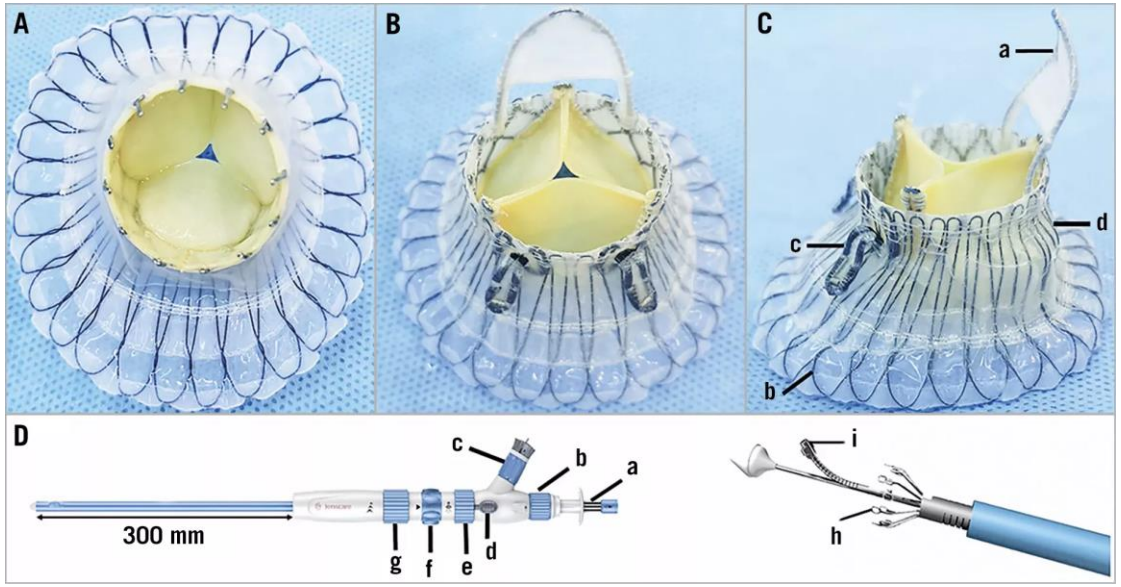


Table 2. Clinical outcome at 30-day follow-up (n=6).

Mortality	0 (0)
Myocardial infarction	0 (0)
Stroke	0 (0)
Convention to surgery	0 (0)
Heart failure hospitalisation	0 (0)
Major bleeding	1 (17%)
Conduction abnormality requiring pacemaker	0 (0)
Dialysis	0 (0)

LuX-Valve: 12-months

Table 3. Baseline and follow-up echocardiographic parameters.

Baseline echo parameters		Patient #1	Patient #2	Patient #3	Patient #4	Patient #5	Patient #6
LAESVI, ml/s²		1,068.9	401.3	159.7	94.9	89.3	306.3
LVEDVI, ml/s²		97.1	56.6	45.6	83.2	56.4	68.0
LVEF, %		60	60	64	56	70	55
RAESVI, ml/s²		167.3	145.7	75.1	126.0	319.5	330.5
RVEDAI, cm²/s²		14.3	16.5	13.7	16.1	24.6	28.9
TAPSE, cm		1.5	1.8	2.0	1.2	1.3	1.1
RV fractional area change, %		25	45	47	23	22	48
RV global longitudinal strain, %		–13.7	–10.2	–12.6	–15.7	–14.9	–12.8
Mean transvalvular gradient, mmHg		2.2	4.6	3.7	3.3	6.6	4.5
TR defining parameters	EROA, cm²	1.0	0.7	1.1	0.9	1.2	0.8
	VC width, mm	11	8	13	10	16	9
	IVC, mm	28	24	29	28	30	32
TR grade		Torrential	Massive	Torrential	Torrential	Torrential	Torrential
TV annular diameter (4Ch, end-diastole), cm		4.0	4.1	4.1	4.6	4.7	4.4
Minimum/maximum diameters of TV annular (3D TEE, end-diastolic), cm		3.8×4.1	4.0×4.3	4.1×4.2	4.1×4.6	4.1×4.7	4.0×4.5
Baseline CT annular measurements (end-diastolic)	Minimum/maximum diameters, cm	3.9×4.3	3.9×4.4	4.0×4.2	4.2×4.8	4.3×5.0	4.1×4.7
	LuX-Valve model implanted	JS/TTVI-28-50	JS/TTVI-28-50	JS/TTVI-28-50	JS/TTVI-28-55	JS/TTVI-28-55	JS/TTVI-28-55
Release time of the guiding sheath, min		10.7	6.2	8.5	9.8	13.6	9.1
Intraprocedural, post-device TEE	Tricuspid regurgitation, total	Moderate	No	No	Mild	Mild	Mild
	Central	No	No	No	No	No	No
	Paravalvular	Moderate	No	No	Mild	Mild	Mild
One-year follow-up, post-device TTE	RAESVI, ml/s²	/	85.9	56.4	93.3	105.4	152.0
	RVEDAI, cm²/s²	/	9.7	8.3	11.5	19.8	17.7
	TAPSE, cm	/	2.0	1.8	1.7	1.5	1.9
	RV fractional area change, %	/	47	39	32	26	40
	RV global longitudinal strain, %	/	–17.5	–19.3	–22.1	–20.4	–18.2
	Mean transvalvular gradient, mmHg	/	3.1	2.4	1.8	4.1	2.2
	Tricuspid regurgitation, total	/	No	No	Mild	Mild	Mild
	Central	/	No	No	No	No	No
	Paravalvular	/	No	No	Mild	Mild	Mild

CT: computed tomography; EROA: effective regurgitant orifice area; IVC: inferior vena cava; LAESVI: left atrium end-systolic volume index; LVEDVI: left ventricular end-diastolic volume index; LVEF: left ventricular ejection fraction; RAESVI: right atrium end-systolic volume index; RV: right ventricular; RVEDAI: right ventricular end-diastolic area index; TAPSE: tricuspid annular plane systolic excursion; TEE: transoesophageal echocardiography; TR: tricuspid regurgitation; TV: tricuspid valve

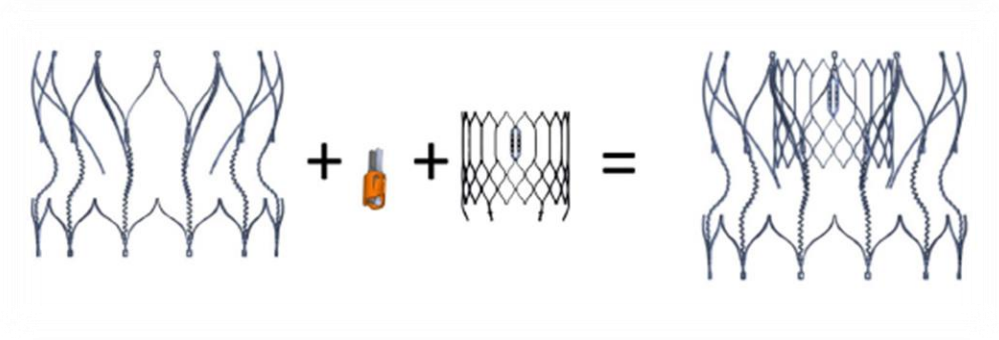
Release time of the guiding sheath, min		10.7	6.2	8.5	9.8	13.6	9.1
Intraprocedural, post-device TEE	Tricuspid regurgitation, total	Moderate	No	No	Mild	Mild	Mild
	Central	No	No	No	No	No	No
	Paravalvular	Moderate	No	No	Mild	Mild	Mild
One-year follow-up, post-device TTE	RAESVI, ml/s²	/	85.9	56.4	93.3	105.4	152.0
	RVEDAI, cm²/s²	/	9.7	8.3	11.5	19.8	17.7
	TAPSE, cm	/	2.0	1.8	1.7	1.5	1.9
	RV fractional area change, %	/	47	39	32	26	40
	RV global longitudinal strain, %	/	–17.5	–19.3	–22.1	–20.4	–18.2
	Mean transvalvular gradient, mmHg	/	3.1	2.4	1.8	4.1	2.2
	Tricuspid regurgitation, total	/	No	No	Mild	Mild	Mild
	Central	/	No	No	No	No	No
	Paravalvular	/	No	No	Mild	Mild	Mild

CT: computed tomography; EROA: effective regurgitant orifice area; IVC: inferior vena cava; LAESVI: left atrium end-systolic volume index; LVEDVI: left ventricular end-diastolic volume index; LVEF: left ventricular ejection fraction; RAESVI: right atrium end-systolic volume index; RV: right ventricular; RVEDAI: right ventricular end-diastolic area index; TAPSE: tricuspid annular plane systolic excursion; TEE: transoesophageal echocardiography; TR: tricuspid regurgitation; TV: tricuspid valve

Twelve-month outcomes of the LuX-Valve for transcatheter treatment of severe tricuspid regurgitation

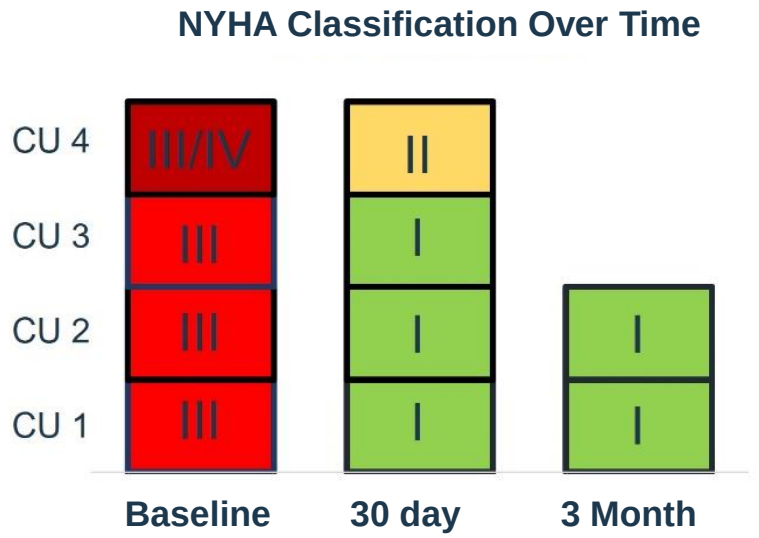
EuroIntervention 2021;17:818-826

TRICARES



- stent très souples permettant de suivre les variations géométriques du VD
- Dé-corrélation de la fonction ancrage et valvulaire

Topaz TTVR - Early Compassionate Use Experience



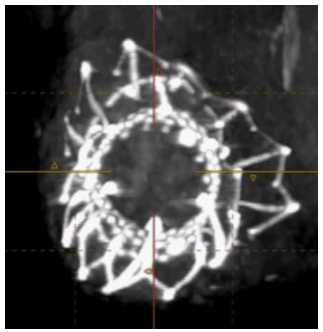
Procedure Discharge	CU 1	CU 2	CU 3	CU4
Procedure Time*	18 min	12 min	20 min	48 min
NYHA Class Discharge	I	I	I	II
Tricuspid Regurgitation (Grade 1-5)	None (0)	None (0)	None (0)	Mild (1)
Discharged on POD	4	4	15	15

* Definition: Time from Topaz delivery system in, followed by valve deployment to delivery system out

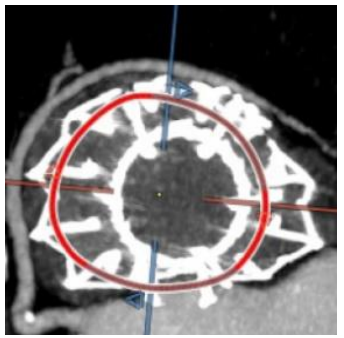
CU 1
post deployment

CU 2
post deployment

CU 1
CT 3 Mon FUP



CU 2
CT 3 Mon FUP



First-in-human implantation of the Topaz transcatheter tricuspid valve replacement system
Teiger E. et al, EuroIntervention 2022; 18

Algorithme décisionnel

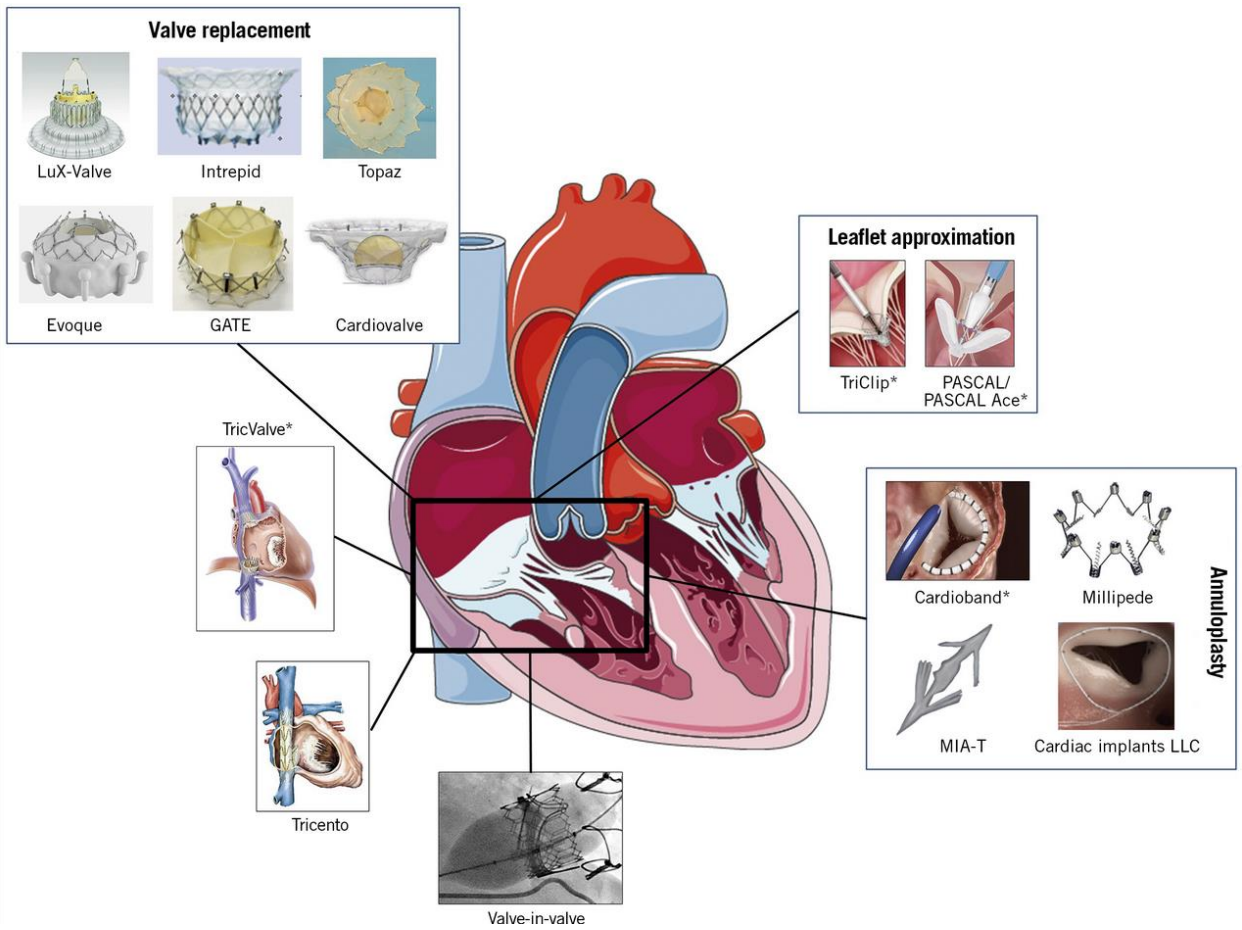


Table 3. Anatomical criteria for device selection.

Strategy	Favourable anatomy	Feasible anatomy	Unfavourable anatomy
Leaflet approximation	Small septolateral gap ≤7 mm[10] Anteroseptal jet location Confined prolapse or flail Trileaflet morphology	Septolateral coaptation gap >7 but ≤8.5 mm[65] Posteroseptal jet location Non-trileaflet morphology Incidental CIED RV lead (i.e., without leaflet impingement)	Large septolateral coaptation gap >8.5 mm[65] Leaflet thickening/shortening (rheumatic, carcinoid)/perforation Dense chordae with marked leaflet tethering Anteroposterior jet location Poor echocardiographic leaflet visualisation CIED RV lead leaflet impingement Unfavourable device angle of approach
Annuloplasty	Annular dilatation as primary mechanism of TR Mild tethering (tenting height <0.76 cm, tenting area<1.63 cm², tenting volume [3D] <2.3 mL)[110,111] Central jet location Sufficient landing zone for anchoring	Moderate tethering (tethering height ≥0.76 cm but <1.0 cm, tenting area >1.63 but <2.5 cm², tenting volume [3D] ≥2.3 mL but ≤3.5 mL)[110,111] Incidental CIED RV lead (i.e., without leaflet impingement)	Excessive annular dilatation (exceeding device size) Severe tethering (tethering height >1.0 cm, tenting volume >3.5 mL). Poor echocardiographic annular visualisation[110,111] Annular proximity of RCA CIED RV lead leaflet impingement
Orthotopic valve implantation	Previous surgical repair or bioprosthetic valve replacement Leaflet thickening/shortening (rheumatic, carcinoid) Incidental CIED RV lead (i.e., without leaflet impingement) Any leaflet morphology	Large coaptation gap CIED RV lead leaflet impingement	Excessive annular dilatation (exceeding device size) Unfavourable device angle of approach Severe right ventricular dysfunction
Heterotopic valve implantation	Appropriate caval diameters (and intercaval distance) No option for direct valve treatment		Proximity of the RA to the orifice of the liver veins (<10-12 mm) Severely increased pulmonary artery and RA pressures due to the risk of fracture of bicaval valved stents

3D: three-dimensional; CIED: cardiac implantable electronic device; RA: right atrium; RCA: right coronary artery; RV: right ventricular; TR: tricuspid regurgitation

State of the Art

Transcatheter treatment for tricuspid valve disease Praz F. et al EUROINTERVENTION November 19, 2021 | 10.4244/EIJ-D-21-00695

Conclusion

- Réparation: TRICLIP, PASCAL, Annuloplastie
  - Exclusions anatomiques: fréquentes
  - Durée de procédure: longue à très longue
  - Dépendance à l'imagerie per-procédure: importante
  - Résultats incomplets ?: à valider sur les études en cours
- Valves percutanées
  - Exclusion anatomique: moins fréquente (évolution taille des dispositifs)
  - Durée de procédure: courte
  - Dépendance à l'imagerie: faible
  - Résultats semble-t-il plus complets