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Transcatheter tricuspid valve repair and implantation

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Disclosures

Physician name	Company	Relationship
Horst Sievert	4tech Cardio, Abbott, Ablative Solutions, Ancora Heart, Bavaria Medizin Technologie GmbH, Bioventrix, Boston Scientific, Carag, Cardiac Dimensions, Celonova, Cibiem, CGuard, Comed B.V., Contego, CVRx, Edwards, Endologix, Hemoteq, InspireMD, Lifetech, Maquet Getinge Group, Medtronic, Mitralign, Nuomao Medtech, Occlutech, pfm Medical, Recor, Renal Guard, Rox Medical, Terumo, Vascular Dynamics, Vivasure Medical, Venus, Veryan	Consulting fees, Travel expenses, Study honoraria

What can cause TR?

- Primary TR

- Ebstein
- Myxomatous
- Carcinoid disease
- Endomyocardial fibrosis
- Rheumatic
- Endocarditis
- Traumatic
- Pacemaker leads

- Secondary TR

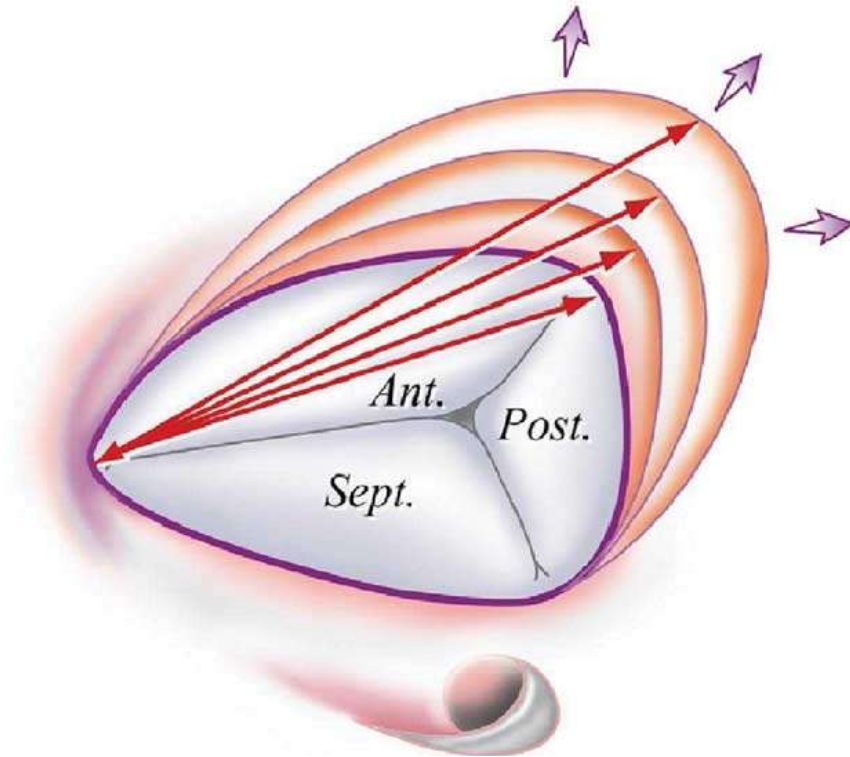
- Left heart failure
- Pulmonary hypertension
- RV dysfunction
- Atrial fibrillation

> 90%
of all TR

Incidence of moderate to severe TR in different patient populations

Population	TR severity	TR prevalence	FU	Ref
MitraClip	Moderate to severe	11 %	1 y	Ohno (2014)
TAVI	Moderate to severe	21 %	30 d	Barbanti (2015)
TAVI	Moderate to severe	16 %	1 y	Lindman (2015)
SAVR	Mild to severe	21 %	4,4 y	Jeong (2014)
Valvuloplasty for rheumatic MS	Moderate to severe	19 %	12 y	Lee, S.-P (2013)
MV surgery for degenerative MV disease	Severe	6 %	> 5 y	Rajbanshi (2014)
MV repair in dilated cardiomyopathy	Moderate to severe	20 %	7.3 y	De Bonis (2015)

Anatomic changes in functional TR



- The septum is in a fixed position
- Therefore, the annulus dilates on the side of the free wall

- RV dilation causes further annular dilation
- This causes increasing TR and worsened RV overload and dilatation

Clinical Symptoms

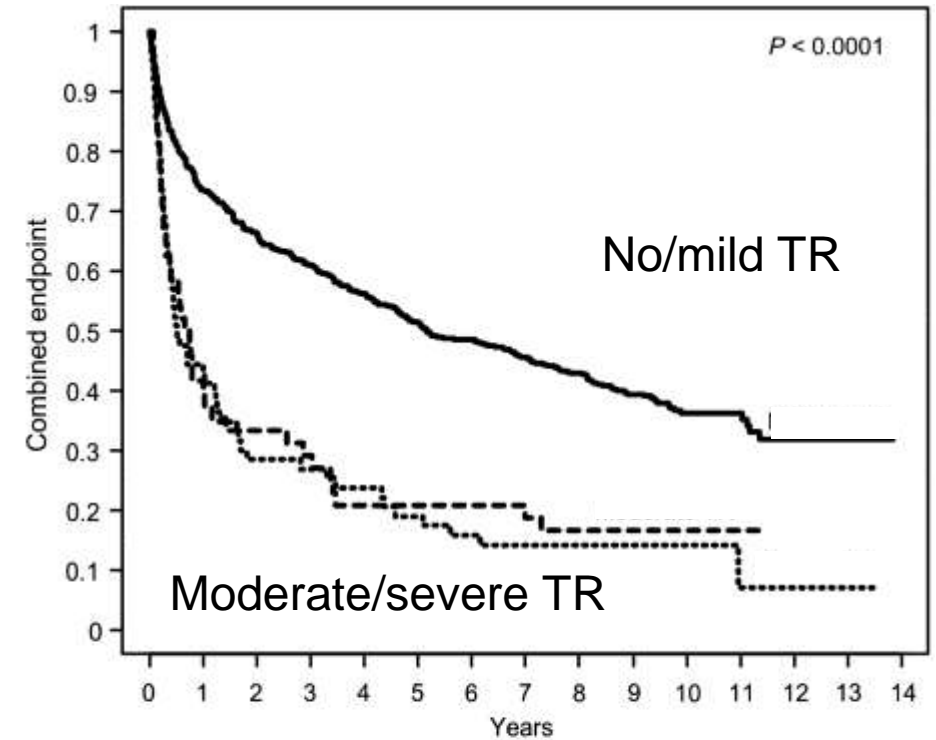
- Low output
 - Fatigue, reduced exercise capacity
- Congestion
 - Peripheral edema
 - Ascites, hepatomegaly, cirrhosis
 - Low appetite, cachexia
 - Atrial fibrillation

What is the prognosis
of tricuspid insufficiency?

TR in chronic left heart failure

- 576 patients with left heart failure
- Worse outcome of patients with significant TR ($P < 0.0001$)
- FU 5.8 ± 4.2 years
- Endpoint death/heart transplantation/left ventricular-assist device

Kaplan–Meier curves for overall survival.



Year	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Mild TR (n=465)														
Endpoint	123	158	181	203	225	239	253	265	279	287	287	291	291	291
N. at Risk	342	307	284	262	240	226	212	187	136	77	35	17	5	0
Moderate TR (n=48)														
Endpoint	28	32	34	38	38	38	39	40	40	40	40	40	40	40
N. at Risk	20	16	14	10	10	10	9	5	4	4	1	0	0	0
Severe TR (n=63)														
Endpoint	36	45	46	48	51	53	54	54	54	54	55	55	55	55
N. at Risk	27	18	17	15	12	10	9	6	5	3	1	1	1	0

TR is not reversible

- Usually, it does not go away after mitral valve repair!
- McCarthy, ATS 2004:
 - 5589 pts with mitral valve repair only
 - 16% had severe TR before
 - At discharge, 62 % still had severe TR

Transcatheter Tricuspid Repair and Replacement

- MitraClip for tricuspid
- FORMA (Spacer)
- Mistral
- Mitralign → Trialign
- 4Tech
- TRAIPTA
- Millipede
- Cardioband TR
- Caval valve implants
- Valve in surgical valve
- Tricuspid valve implantation

Mitraclip

Percutaneous Edge-to-edge Repair of Tricuspid Regurgitation in Congenitally Corrected Transposition of the Great Arteries

Olaf Franzen MD¹, Patrick von Samson MD^{2,*}, Ali Dodge-Khatami MD², Gerd Geffert MD³ and Stephan Baldus MD¹

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Issue



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Before Clip



2 months after Clip

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Edwards FORMA Repair System

FORMA System

1. Spacer

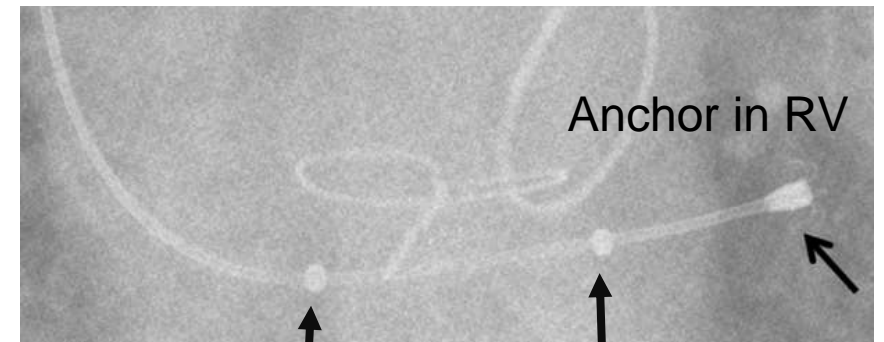
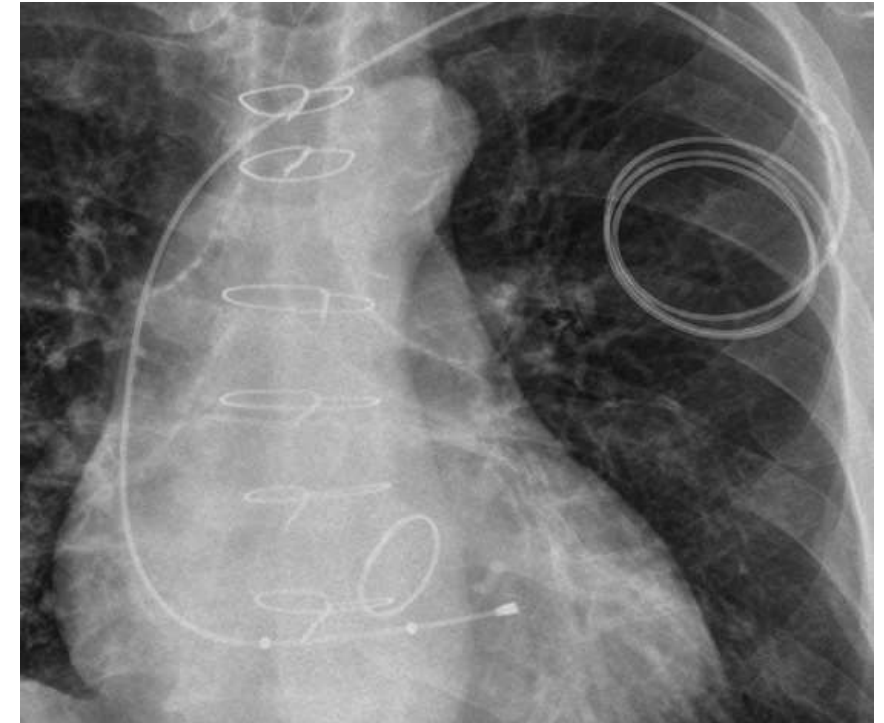
- Positioned into the tricuspid valve orifice
- Creates a platform for native leaflet coaptation

2. Rail

- Tracks Spacer into position
- Distally and proximally anchored



N = 18



Anchor in RV

Radiopaque markers of the coaptation system

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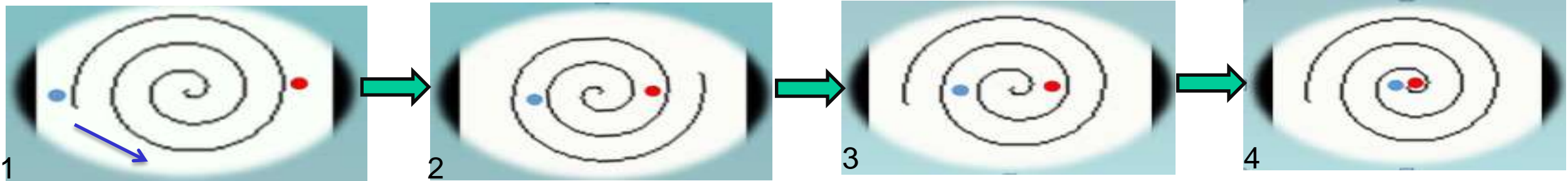
Mistral Device



Mistral

- Trans-septal approach
- 12 Fr Delivery System

Mode of Action -



1 Start to turn

● - Chords from **Posterior** Leaflet

● - Chords from **Anterior** Leaflet

4 **Grasped Chords!**

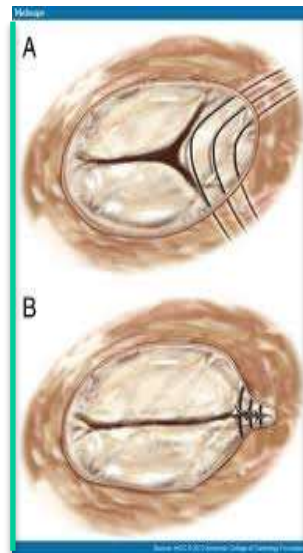
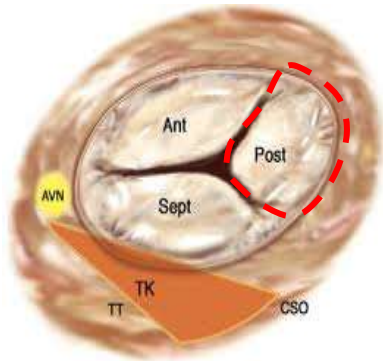
FIM tricuspid done

Transcatheter Tricuspid Repair and Replacement

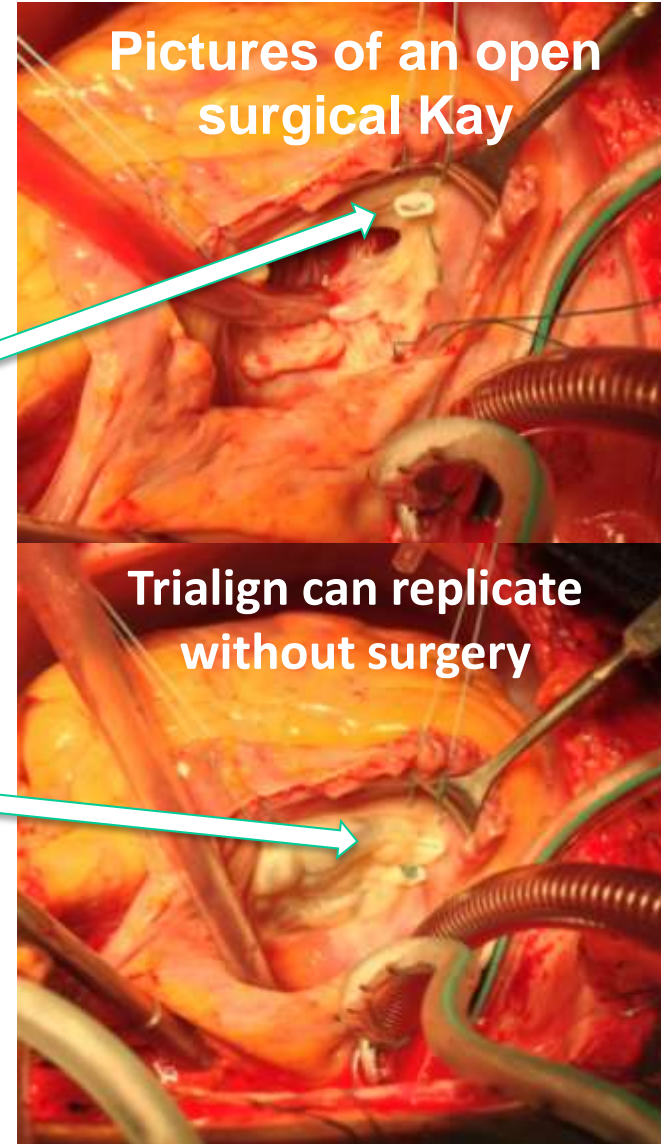
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Trialign replicates a surgical procedure (Kay Procedure)

Kay converts an incompetent tricuspid into a competent bicuspid valve



- 1st Pledget is placed at the Antero-Posterior Commissure
- 2nd pledget is placed at the Septo-Posterior Commissure
- Pledgets are cinched together obliterating the posterior leaflet



Pictures of an open surgical Kay

Trialign can replicate without surgery

Trialign

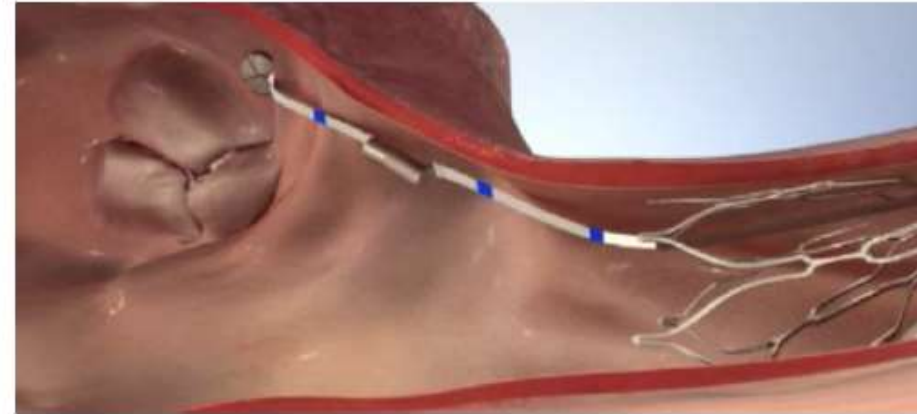
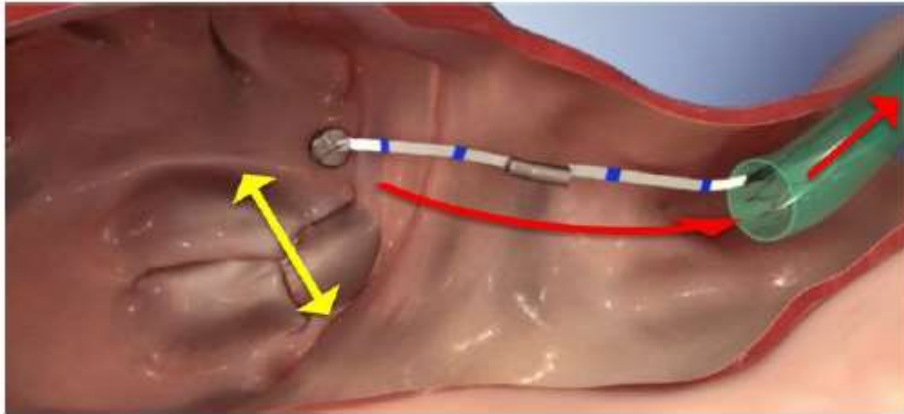
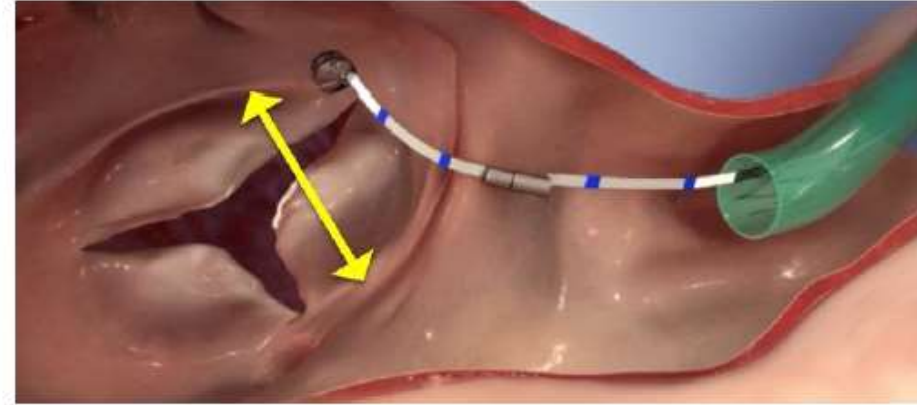
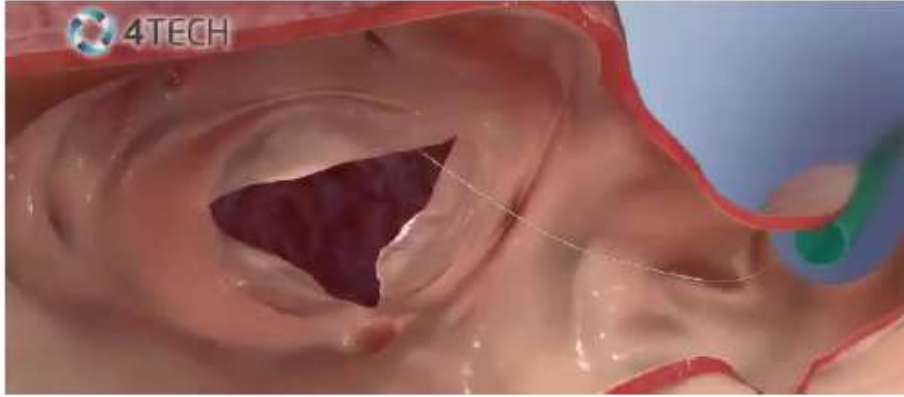
- Polyester Pledget: 3mm x 7.5mm
- Braided 2.0 Polyester Suture
- Stainless Steel Lock
 - 2mm x 2.5mm x 4.5mm



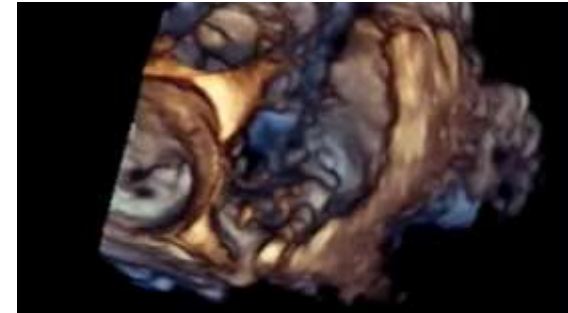
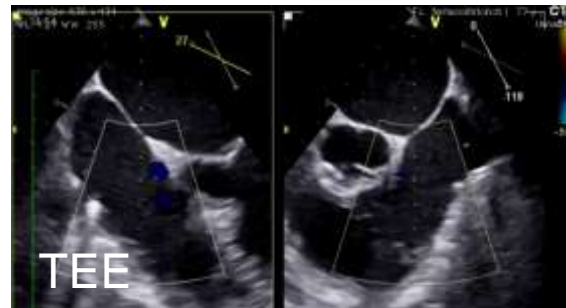
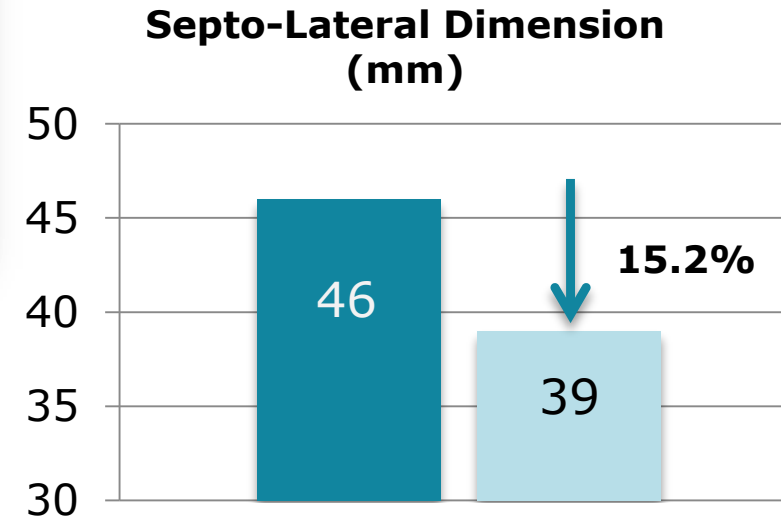
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4Tech TriCinch



Echocardiographic results



4 TECH (TriCinch) New Anchoring Mechanisms

TriCinch Gen 1.5



TriCinch Coil Tip



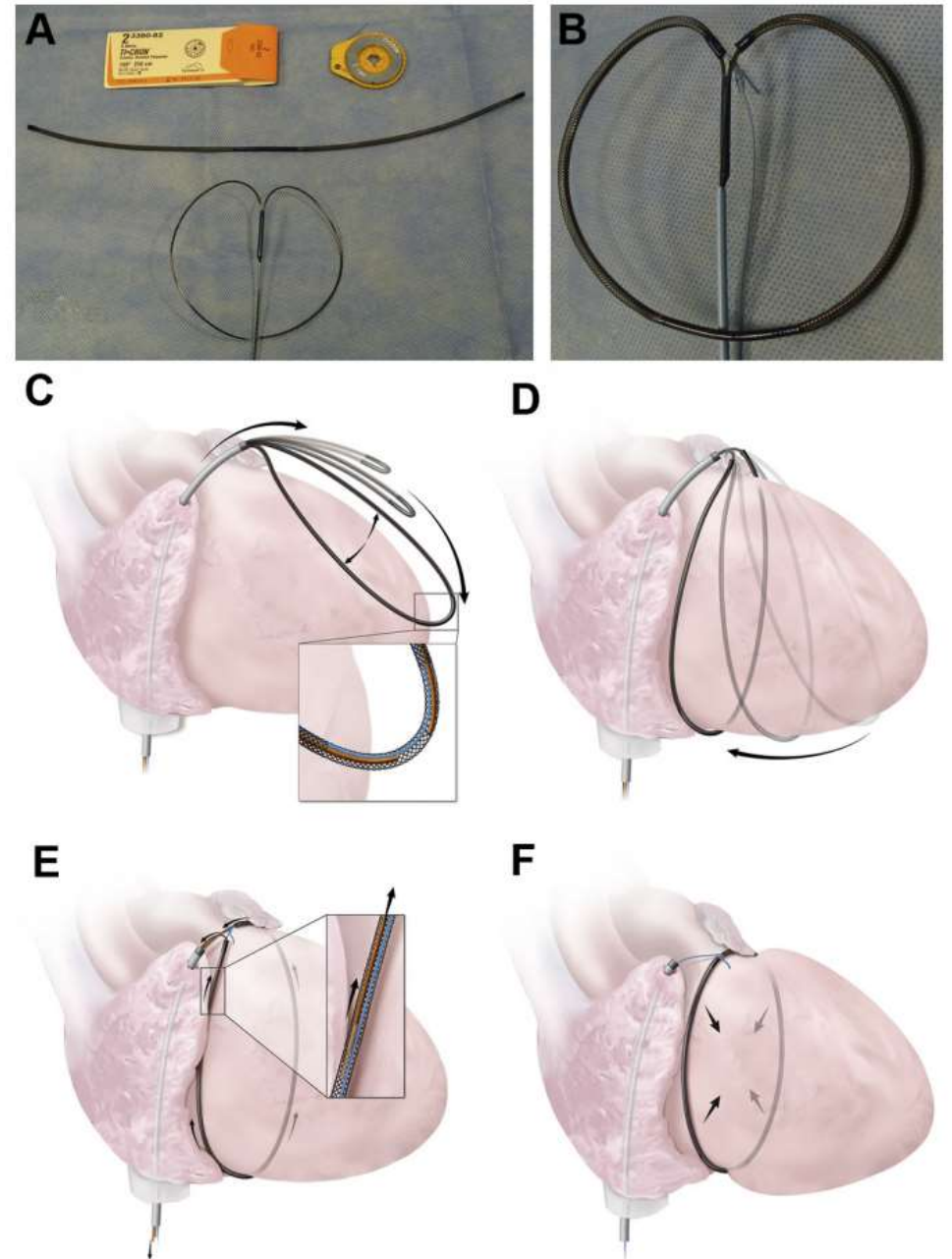
- Nitinol wire transforms into hemi-spiral shaped anchoring system
- Deployed in the pericardial space
- Independent from RCA location
- Integrated hemostasis element (optimal sealing)

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TRAIPTA

- RAA puncture → pericardial access
- Circumferential implant delivered along atrioventricular groove
- Tension adjusted
- RAA puncture hole closed with an umbrella closure device

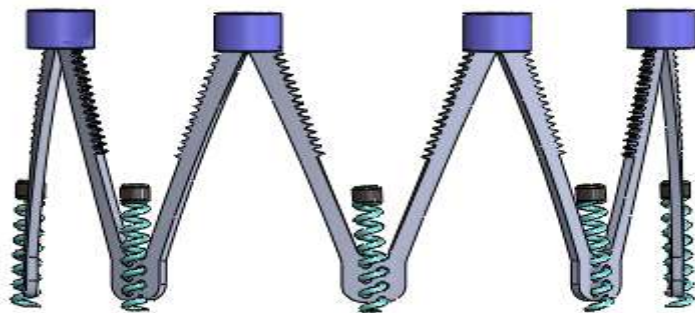
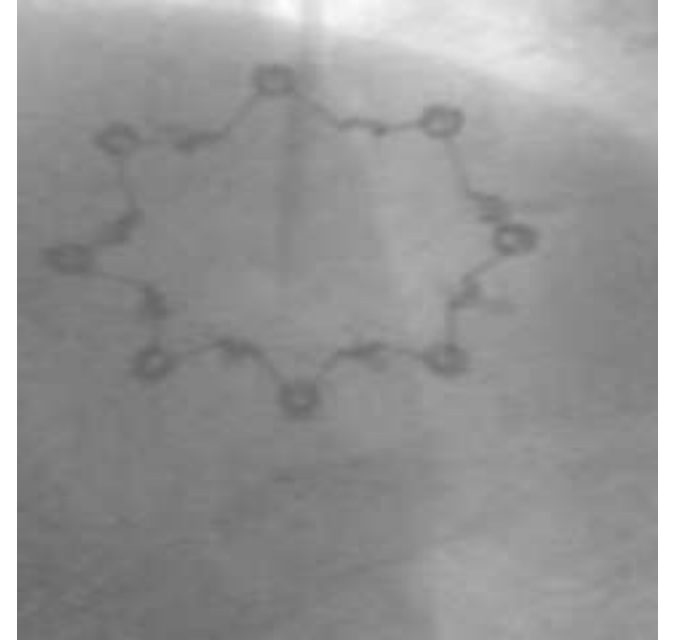


Transcatheter Tricuspid Repair and Replacement

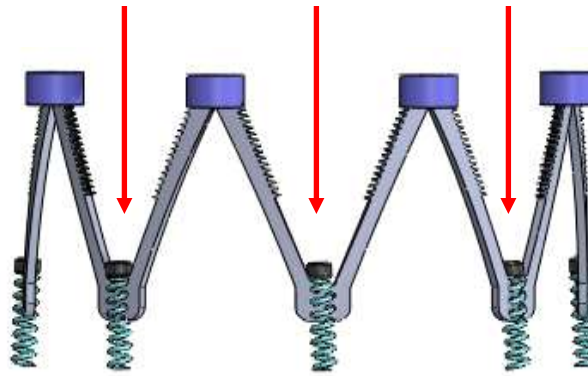
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Tricuspid Millipede

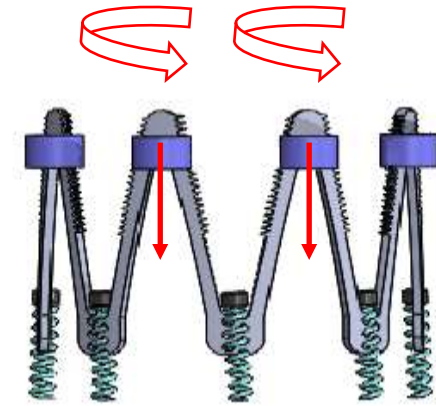
- Transfemoral delivery
- Semi-rigid adjustable complete ring
- FIM N=2 (together with mitral)



#1 Placement



#2 Annular Attachment

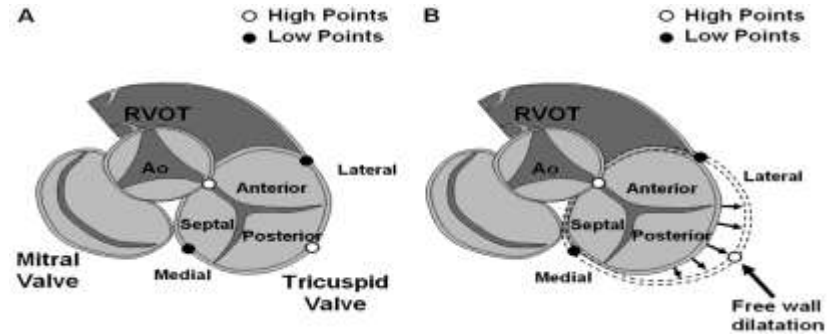


#3 Annular Reduction

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Cardioband TR (Valtech)



Ton-Nu, T.-T. et al. Circulation 2006;114:143-149

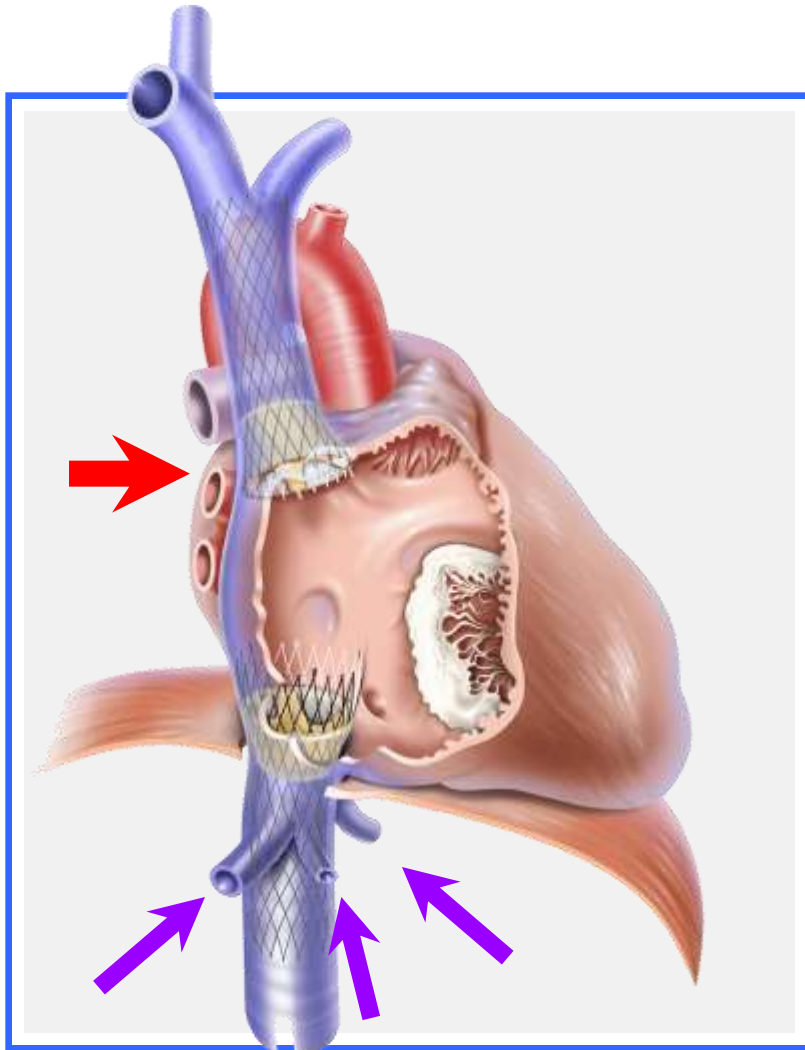
- Annuloplasty technique CE marked for MV
- Same implant and delivery system



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Transcatheter CAVI



- Implantation of self-expandable valve in SVC
- Implantation of self-expandable valve in IVC at cavo-atrial junction above hepatic vein inflow

Transcatheter Tricuspid Repair and Replacement

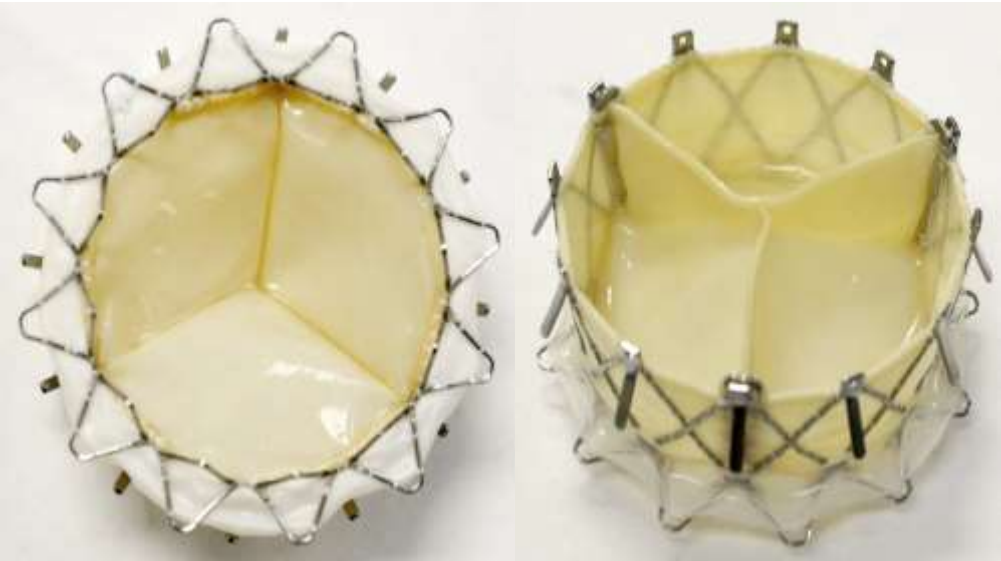
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NaviGate

Tricuspid Valve Stent and Delivery Systems

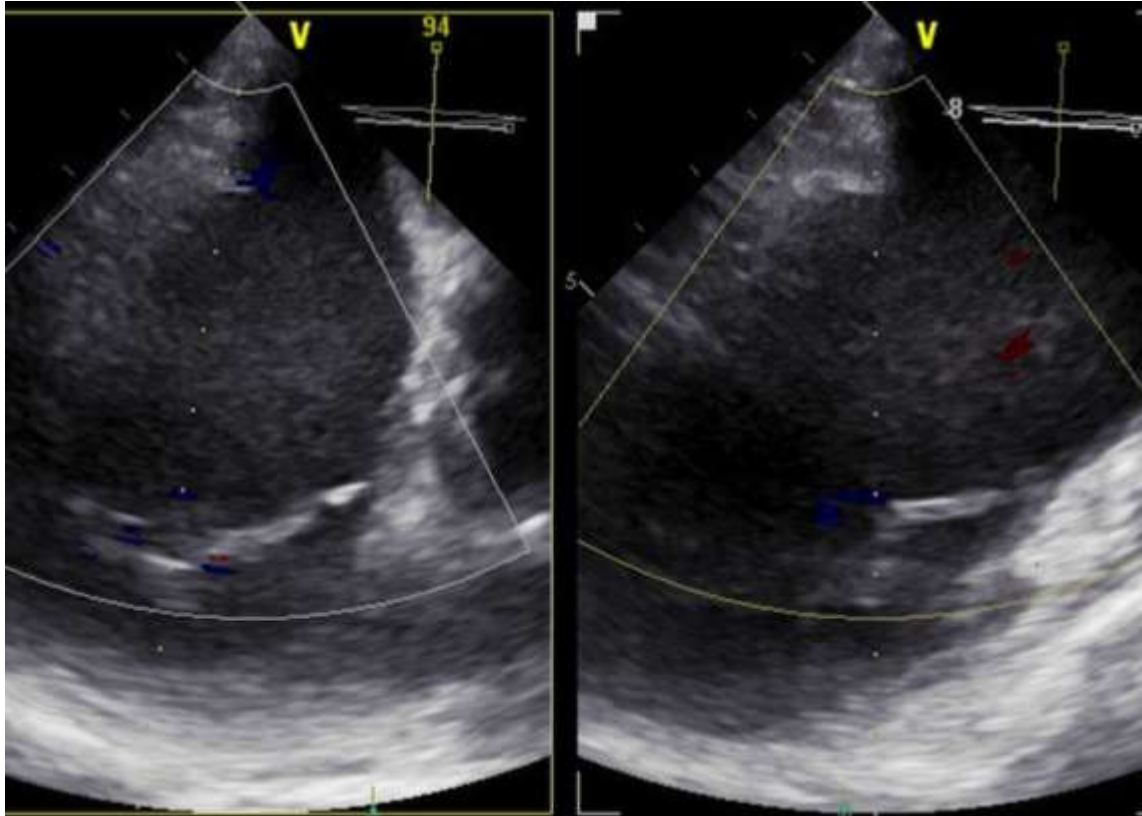


- Nitinol Tapered Stent
- Height 21 mm
- Annular Winglets and leaflet anchors
- Sizes= 36 40, 44, 48, 52 mm.
- Xenogeneic Pericardium

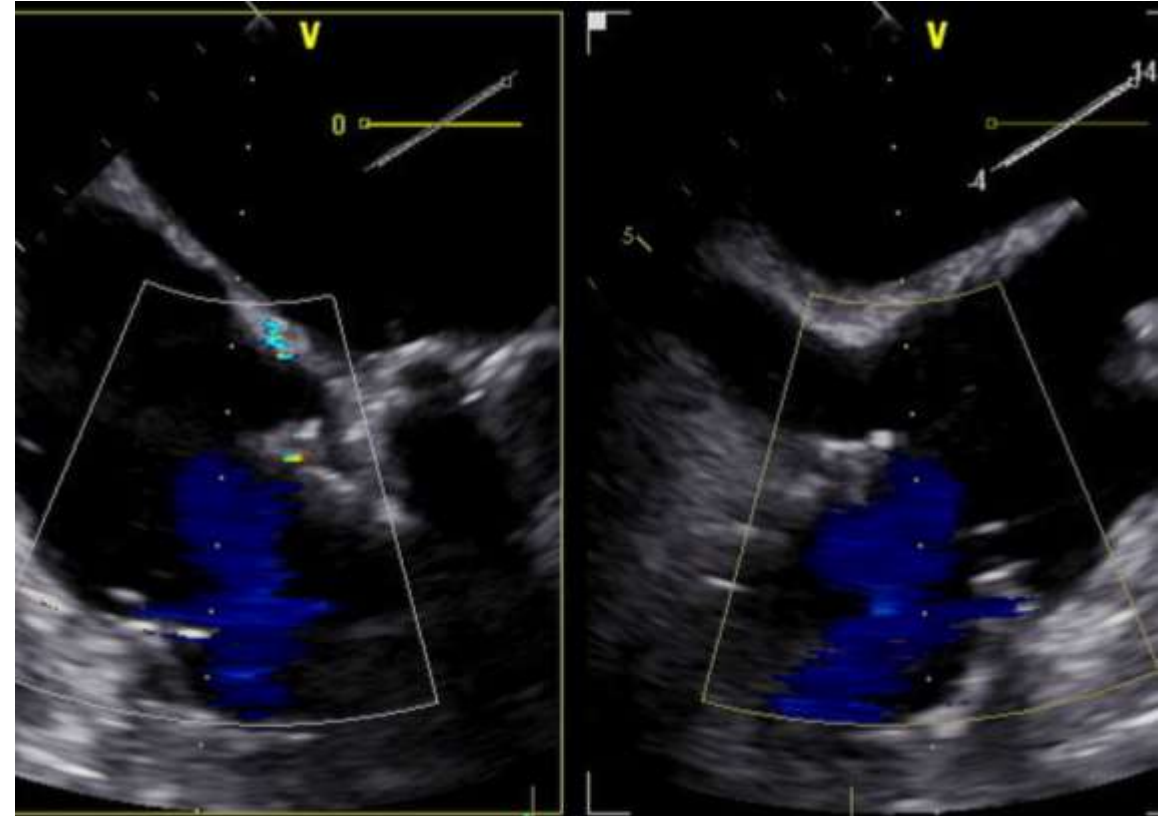
Samir Kapadia



Navigate tricuspid valve implantation 1st patient in Frankfurt



before



after

Tricuspid valve interventions

- Like in the mitral position, we will need different repair techniques for different morphologies, may be in combination
- Imaging is even more complex and even more important than in most other interventions including mitral
- Current results of repair are promising but not optimal yet
- Tricuspid valve implantation has taken off

Thank you!

LIVE CASES

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