

Cartagena de Indias, Colombia. September 2017

# Isolated tricuspid valve surgery: timing and indications

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Be conservative used to be the best way in most things

## Conservative Management of Tricuspid Regurgitation in Patients Undergoing Mitral Valve Replacement

By NINA S. BRAUNWALD, M.D., JOHN ROSS, JR., M.D., AND  
ANDREW G. MORROW, M.D.

### Summary:

In many patients with advanced mitral valve disease, associated tricuspid regurgitation is of a functional nature and secondary to right ventricular hypertension and dilatation of the tricuspid annulus. The present results indicate that in such patients tricuspid regurgitation will improve or disappear after mitral replacement and that tricuspid valve replacement is seldom necessary.

Circulation 1967;35:1-63

Repairing or replacing the mitral will improve the tricuspid. TV surgery is seldom necessary



# Why is so important to know the history ???

One can easily ignore tricuspid insufficiency when fixing the left sided valves, because it always goes away spontaneously.

Nina Braunwald, 1967



# Why is so important to know the history ???



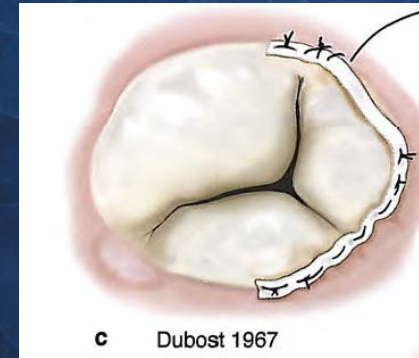
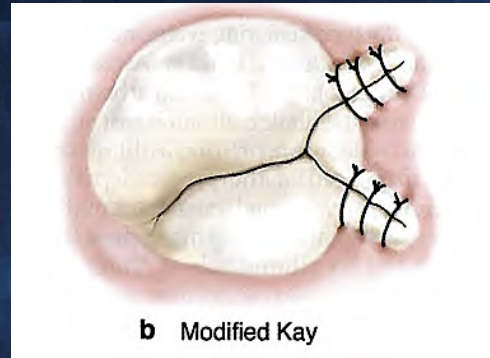
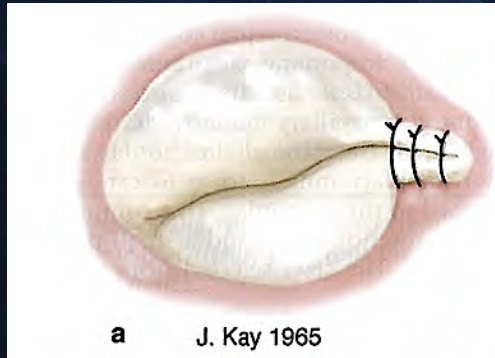
The most remarkable fact about Braunwald's paper is that, despite a large body of contradictory published work, the myth she perpetrated had an amazing life.

Robert Frater, 2006

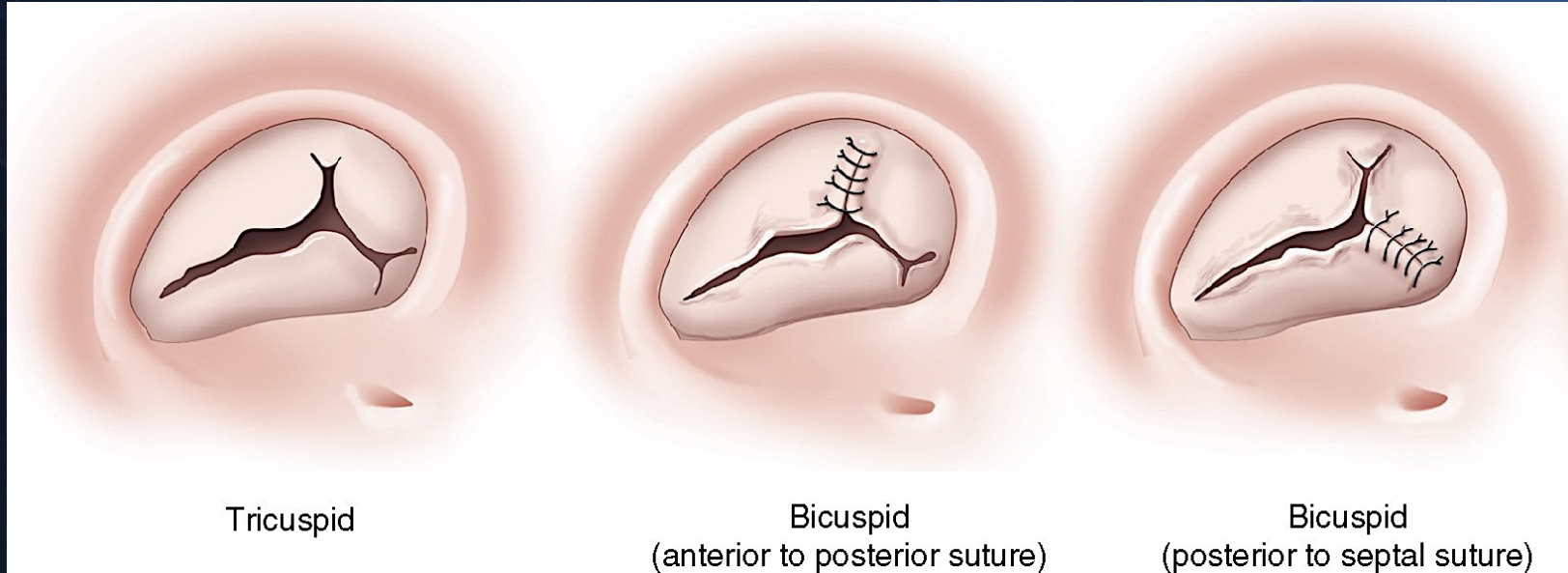




# Techniques used in the past: before and after CPB

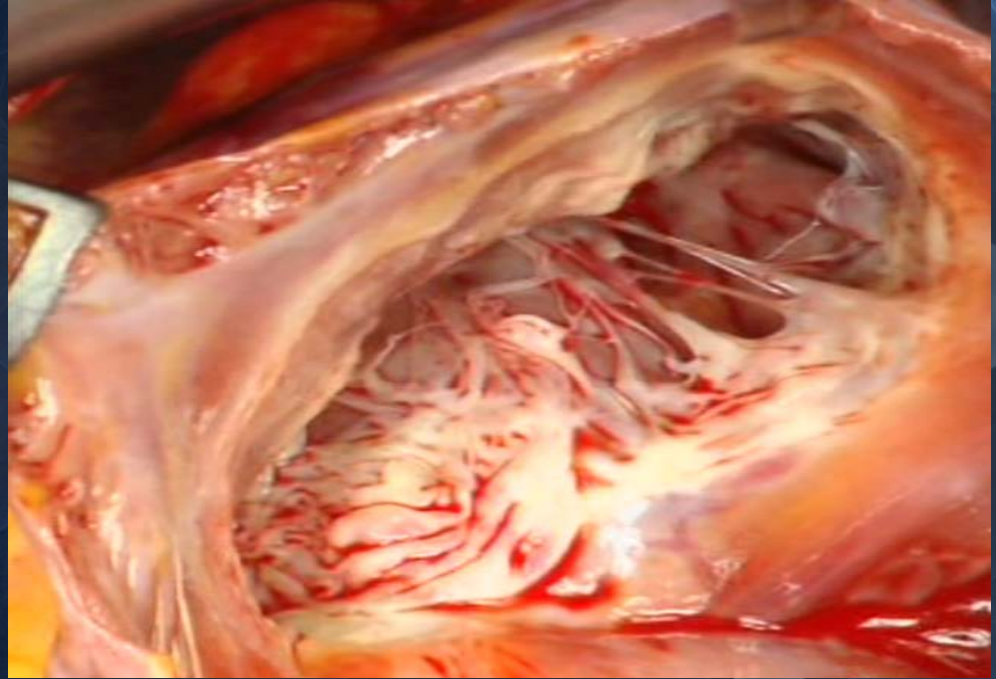
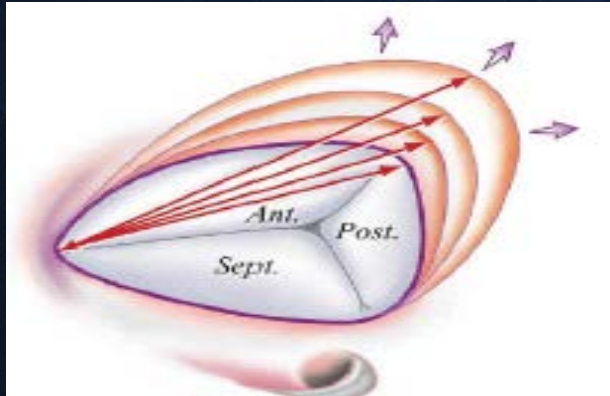


# Techniques used in the past



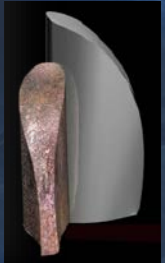
STS and EACTS meet in Latin América

# Is indeed the ignored valve?



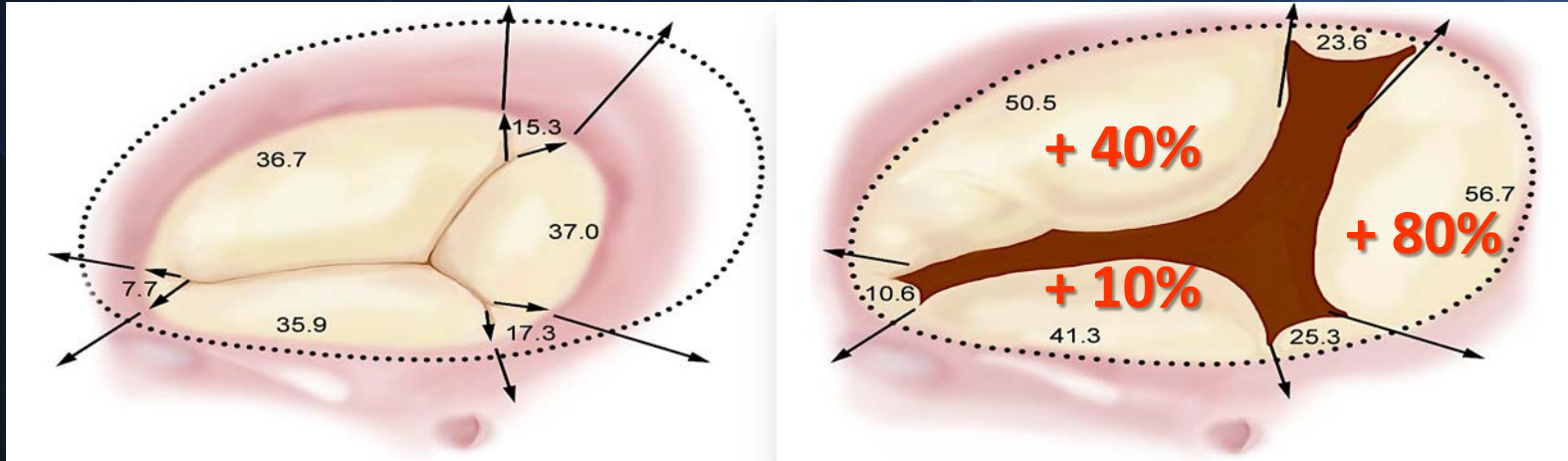
1973

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# Is indeed the ignored valve?



**Normal Annulus**

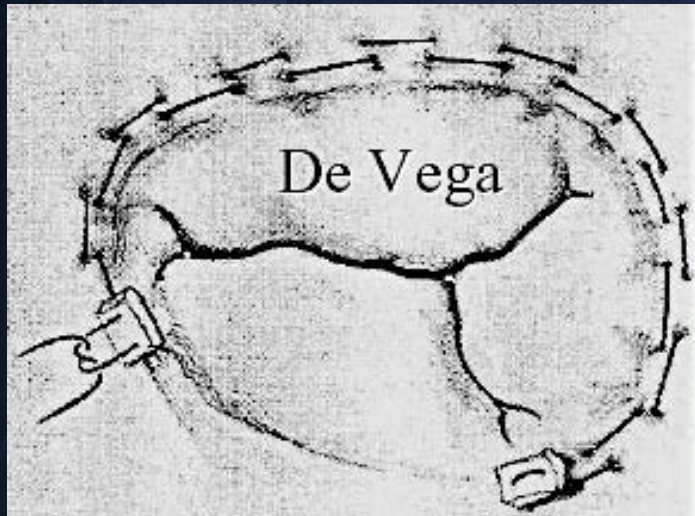
**Dilated Annulus**

Deloche et al., Ann Chir Thorac Cardiovasc, 1973, 12



# De Vega Suture Annuloplasty

Rev Esp Cardiol. 1972 Nov-Dec;25(6):555-6.  
**Selective, adjustable and permanent annuloplasty.**  
**An original technic for the treatment of tricuspid insufficiency**



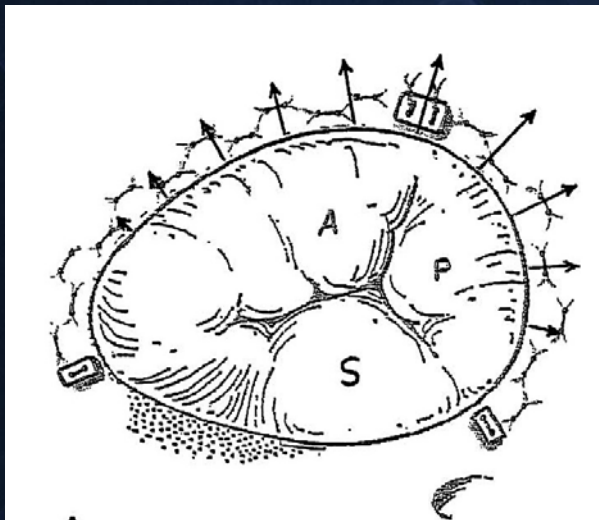
## Healthcare: facts & lies

Most of the opinions in the media about our healthcare system are characterized by ignorance and/or political sectarianism

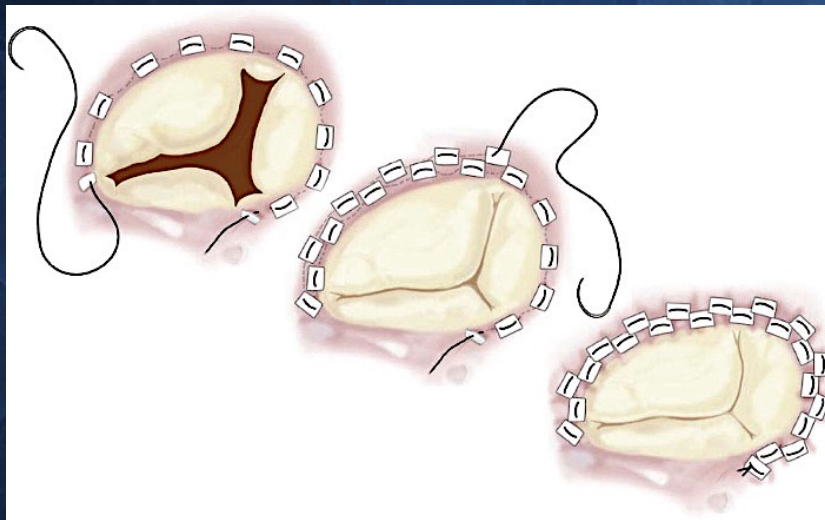


STS and EACTS meet in Latin América

# De Vega Suture Annuloplasty



Goksin I.- J Card Surg 2006;21:172-5



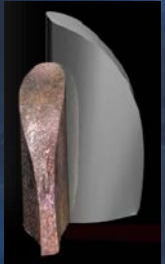
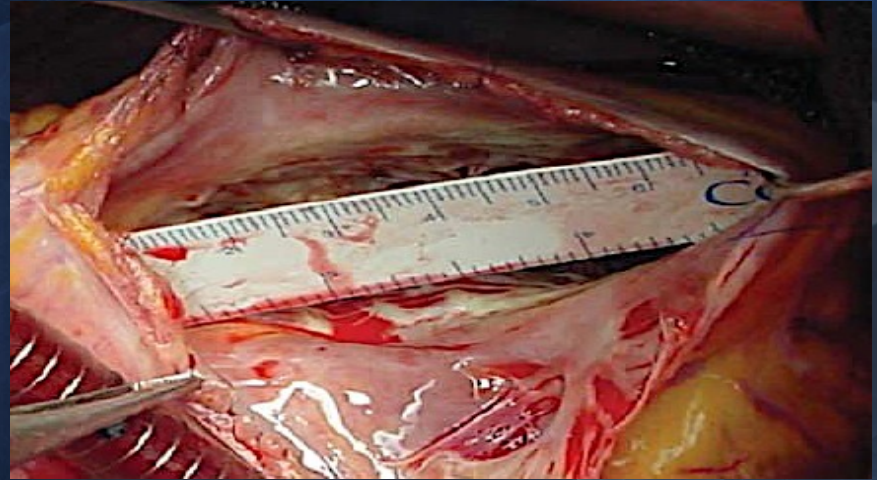
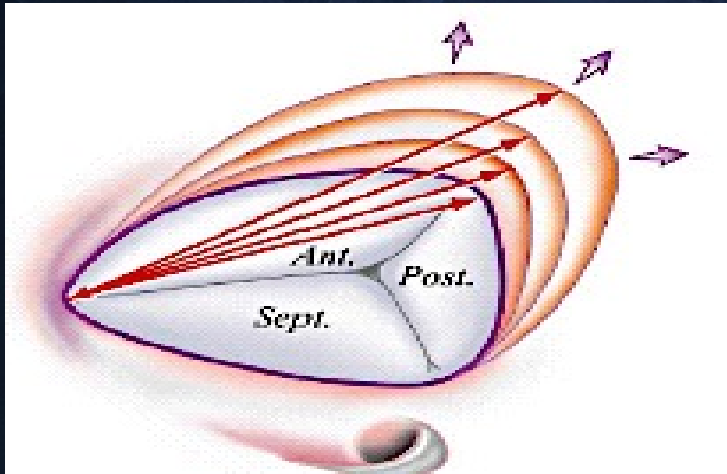
Antunes M.- Ann Thorac Surg 1983;35:676-8.



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# Is indeed the ignored valve?

Annulus dilatation : Surgical cut-off value 70 mm

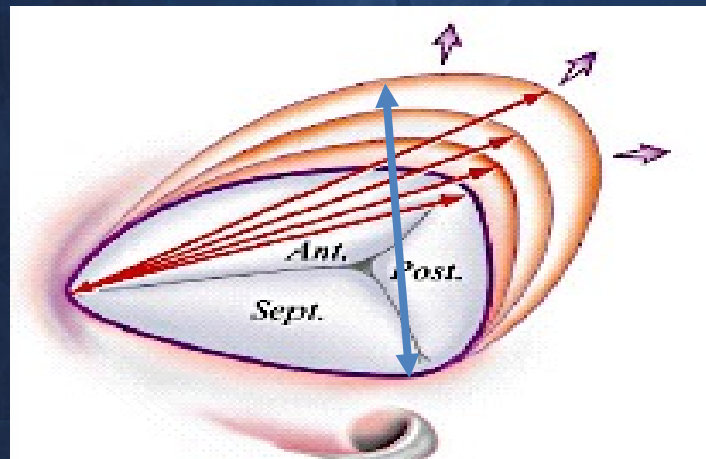
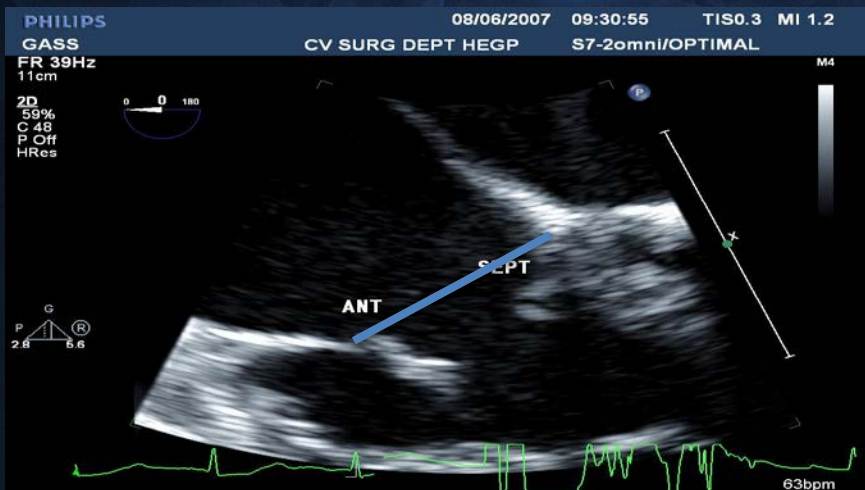


Dreyfus G and al. Ann Thorac Surg 2005;79:127–32

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# Is indeed the ignored valve?

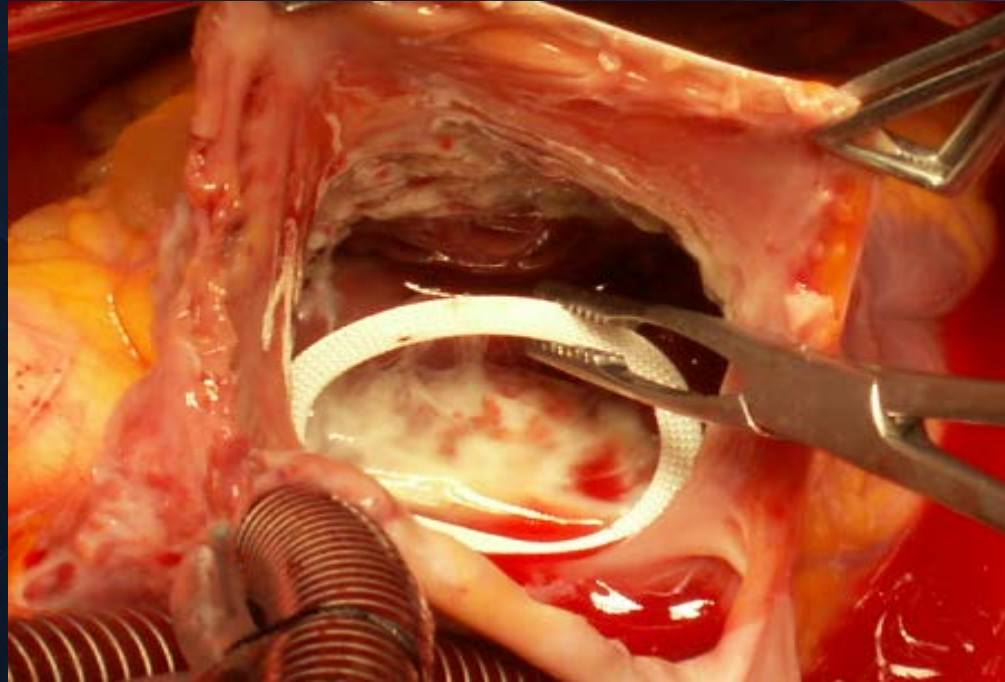
**Annulus dilatation** : Echo cut-off value 40 mm ( not evident who studied that) or 21 mm/m<sup>2</sup> as proposed by Colombo



Antonio Colombo: San Raffaele Hospital, Milan

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# Annuloplasty Rings for a reverse remodeling



Who has quantified what a  
MODERATE TR is?

We know mild and severe



# Indications for surgery in tricuspid disease

	Class	Level
Surgery is indicated in symptomatic patients with severe TS.	I	C
Surgery is indicated in patients with severe TS undergoing left-sided valve intervention.	I	C
Surgery is indicated in patients with severe primary, or secondary, TR undergoing left-sided valve surgery.	I	C
Surgery is indicated in symptomatic patients with severe isolated primary TR without severe right ventricular dysfunction.	I	C
Surgery should be considered in patients with moderate primary TR undergoing left-sided valve surgery.	IIa	C
Surgery should be considered in patients with mild or moderate secondary TR with dilated annulus ( $\geq 40$ mm or $> 21$ mm/m <sup>2</sup> ) undergoing left-sided valve surgery.	IIa	C
Surgery should be considered in asymptomatic or mildly symptomatic patients with severe isolated primary TR and progressive right ventricular dilation or deterioration of right ventricular function.	IIa	C
After left-sided valve surgery, surgery should be considered in patients with severe TR who are symptomatic or have progressive right ventricular dilatation/dysfunction, in the absence of left-sided valve dysfunction, severe right or left ventricular dysfunction, and severe pulmonary vascular disease.	IIa	C

European Heart Journal 2012 - doi:10.1093/eurheartj/ehs109 &  
European Journal of Cardio-Thoracic Surgery 2012 -  
doi:10.1093/ejcts/ezs455).

# Recurrent TR: Ring vs Suture Annuloplasty

## Tricuspid Valve Repair With an Annuloplasty Ring Results in Improved Long-Term Outcomes

Gilbert H. L. Tang, MD; Tirone E. David, MD; Steve K. Singh, MD; Manjula D. Maganti, MSc; Susan Armstrong, MSc; Michael A. Borger, MD, PhD

**Background**—The purpose of this study was to compare the long-term results of tricuspid valve (TV) repair with or without an annuloplasty ring.

**Methods and Results**—702 patients underwent TV repair at our institution (1978 to 2003), of which 493 had, predominantly, a De Vega procedure (no ring) and 209 had an annuloplasty ring (ring). TV pathology was functional (secondary) in 74% of patients. Concomitant procedures consisted of mitral valve surgery in 80% of patients, aortic valve surgery in 33%, and coronary bypass in 14%. Clinical and echocardiographic follow-up data were obtained. Follow-up was 99% complete and was  $5.9 \pm 4.9$  (mean  $\pm$  SD) years long. Ring patients were younger ( $55 \pm 14$  versus  $59 \pm 14$  years;  $P=0.001$ ) and less likely to have coronary artery disease (10% versus 17%;  $P=0.02$ ), more likely to be female (75% versus 65%;  $P=0.01$ ) and having had previous cardiac surgery (56% versus 42%;  $P=0.001$ ). Operative times were similar between the 2 groups. Long-term survival, event-free survival and freedom from recurrent TR were significantly better in the ring group, and there was a trend toward fewer TV reoperations. Multivariable analysis demonstrated that the use of an annuloplasty ring was an independent predictor of long-term survival (hazard ratio [HR], 0.7; 95% confidence interval [CI], 0.5 to 1.0;  $P=0.03$ ) and event-free survival (HR, 0.8; CI, 0.6 to 1.0;  $P=0.04$ ).

**Conclusions**—Placement of an annuloplasty ring in patients undergoing tricuspid valve repair is associated with improved survival and event-free survival. (*Circulation*. 2006;114[suppl I]:I-577–I-581.)

493 de Vegas's  
209 ring annuloplasty  
(Patients younger)

75% FTR  
Concomitant surg 80%





# Is a “Ring” annuloplasty better?

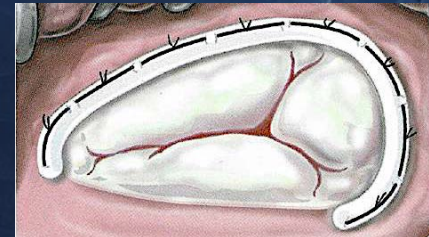
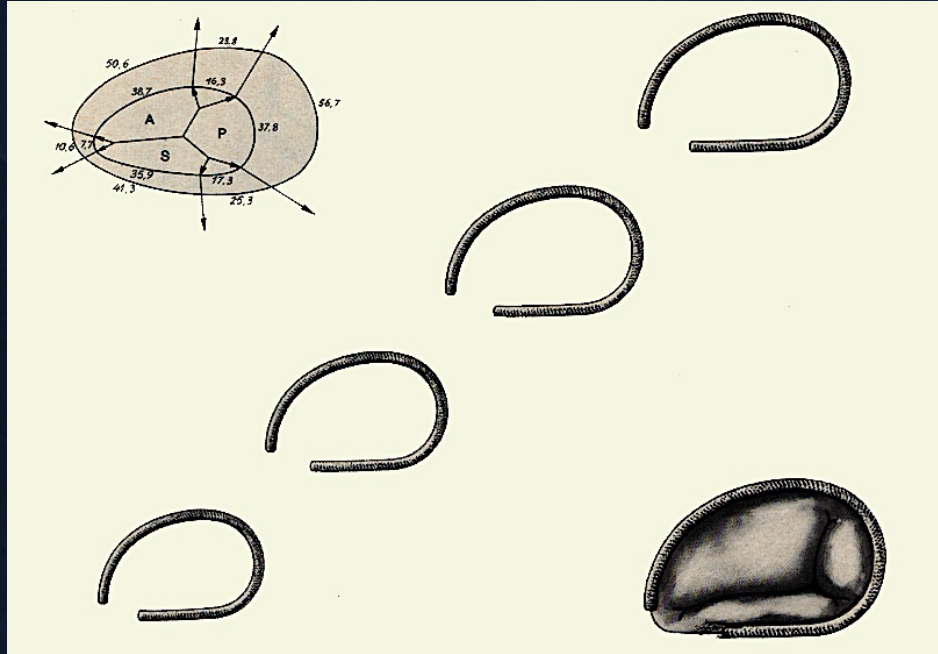
According to **some** papers → Yes

An annuloplasty ring was an independent predictor of:

	<u>Hazard Ratio</u> (HR)	<u>95% CI</u>	<u>p value</u>
Long-term Survival	0.6	0.5-0.9	0.01
Event-free Survival	0.3	0.1-0.7	0.008



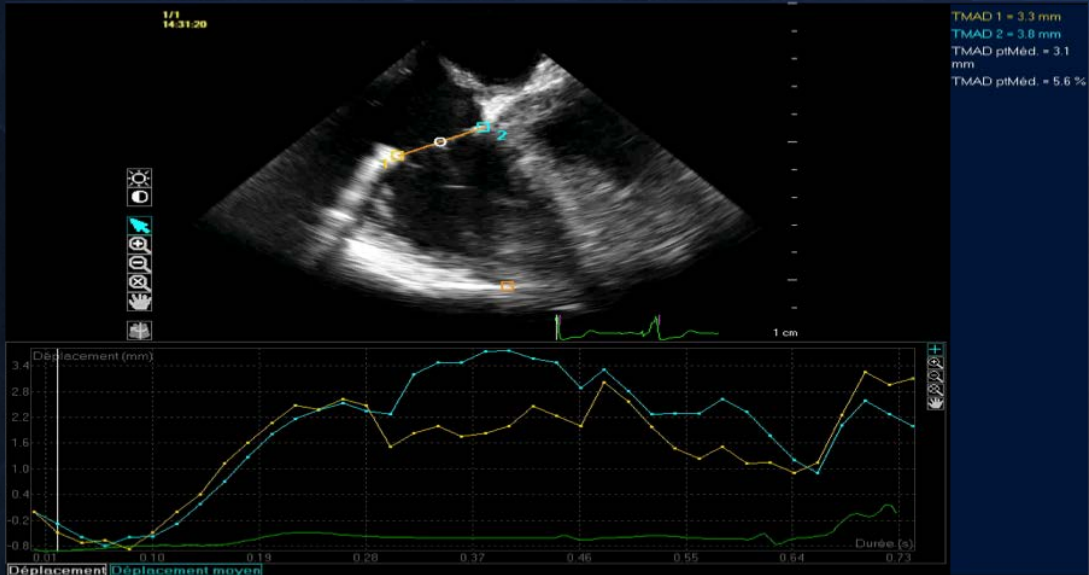
# Annuloplasty Rings are forever... James Bond



STS and EACTS meet in Latin América

# Wave form of Tricuspid Annulus Motion Speckle Tracking

Diastole



Systole

# Increased risk of dehiscence after tricuspid valve repair with rigid annuloplasty rings

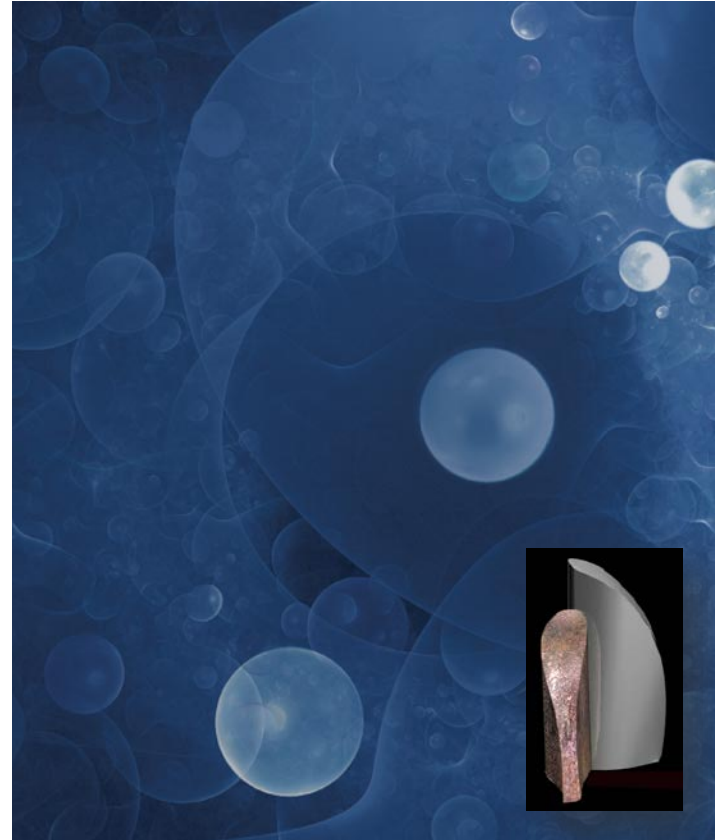
Bettina Pfannmüller, MD, Torsten Doenst, MD, PHD, Katja Eberhardt, BS, Jörg Seeburger, MD, Michael A. Borger, MD, PhD, and Friedrich W. Mohr, MD, PhD

**Objectives:** Surgical management of tricuspid valve regurgitation mainly consists of tricuspid valve annuloplasty, usually performed with implantation of a rigid ring or a flexible band.

**Methods:** We performed a retrospective analysis on 820 patients who underwent tricuspid valve repair between March 2002 and July 2009 with either a flexible Cosgrove-Edwards band (n = 415; Edwards Lifesciences LLC, Irvine, Calif) or a rigid Carpentier-Edwards Classic annuloplasty ring (n = 405; Edwards Lifesciences). Mean patient age was  $69.2 \pm 9.5$  years, 54.1% were female, and average logistic EuroSCORE was  $13.3\% \pm 12.5\%$ . Concomitant procedures were performed in 94.6% of patients (mitral valve surgery, 80.6%; aortic valve surgery, 28.2%; coronary artery bypass grafting, 24.5%; atrial fibrillation ablation, 44.5%). One fifth of the operations were reoperative procedures. Follow-up was 94% complete, with mean duration of  $21.0 \pm 19.0$  months.

**Results:** Thirty-day mortality was 10.1% (Cosgrove-Edwards, 11.9%; Carpentier-Edwards, 8.4%), and 5-year survival was 62.4% (Carpentier-Edwards, 64.7%; Cosgrove-Edwards, 60.3%). Postoperative echocardiography showed significant improvement in tricuspid valve function, with reduction in tricuspid regurgitation grade from  $2.3 \pm 0.7$  to  $0.7 \pm 0.7$ , and no differences between groups. Use of a Carpentier-Edwards ring, however, was associated with significantly higher risk of dehiscence (Carpentier-Edwards, 8.7%; Cosgrove-Edwards, 0.9%;  $P < .001$ ), almost exclusively at the septal leaflet portion of the annulus. Multivariate analysis identified annuloplasty type as independently predicting ring dehiscence (odds ratio, 10.7; 95% confidence interval, 3.2–36.5;  $P < .001$ ). Patients with annuloplasty dehiscence had more residual tricuspid regurgitation on pre-discharge echocardiography than did patients without dehiscence ( $1.4 \pm 0.63$  vs  $0.7 \pm 0.6$ ;  $P < .001$ ). Ten patients underwent reoperation for recurrent tricuspid regurgitation, 4 with ring dehiscence. Five-year freedom from reoperation was 95.3% (Cosgrove-Edwards, 97.7%; Carpentier-Edwards, 92.3%).

**Conclusions:** Although both rigid and flexible systems provide acceptable early tricuspid valve repair results, use of a rigid ring increases risk of subsequent ring dehiscence. (J Thorac Cardiovasc Surg 2012;143:1050-5)



# Annuloplasty Rings may not be forever...



Detachment  
Infection  
TR recurrence



# Isolated Tricuspid surgery

Primary Tricuspid Valve Incompetence or Stenosis

Secondary late Tricuspid Incompetence



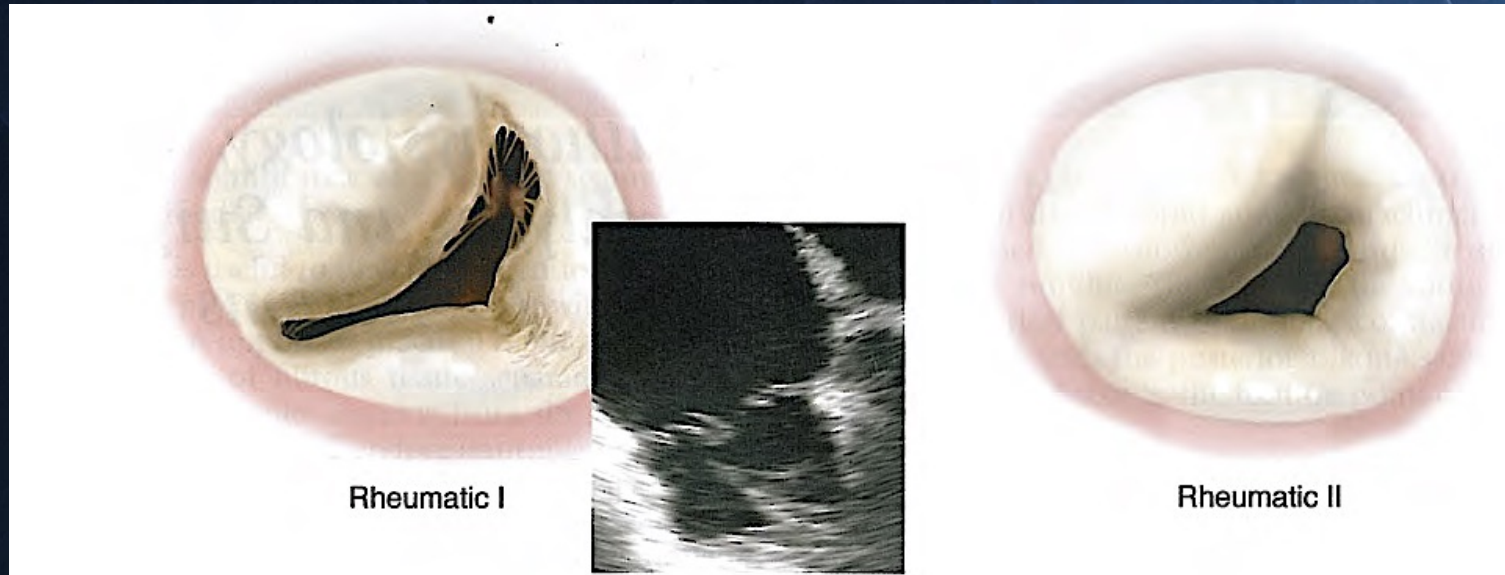
# Isolated Tricuspid surgery

In the absence of left sided pathology, the decision to perform an ITV operation is more controversial. The literature on isolated TV operations is sparse and historically associated with high mortality rates. This is especially true in the setting of right ventricular failure. While some studies have questioned if TV replacement is ever indicated, there is increasing interest in TV pathology and interventions reflected in recent publications.

**Surgical outcomes of isolated tricuspid valve procedures: repair versus replacement** Julius I. Ejiogor, Robert C. Neely, Maroun Yammine, Siobhan McGurk, Tsuyoshi Kaneko, Marzia Leacche, Lawrence H. Cohn, and Prem S. Shekar



# Rheumatic Tricuspid stenosis



STS and EACTS meet in Latin América



# The primary indications for operative intervention

TV endocarditis 25%

Traumatic biopsies and iatrogenic injury from pacing leads 19%

Orthotopic heart transplant (OHT) in 16%

Carcinoid syndrome 5%

Congenital malformations 5%

Idiopathic TV insufficiency in 9%

Persistent TV insufficiency after left sided surgery 21%



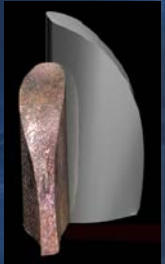
# Why is so important to know the history ???



The presence of significant tricuspid regurgitation, whether in the context of mitral valve disease or heart failure, should no longer be treated with '**surgical abstention**'.

Sean P. Pinney, 2012

Mount Sinai Medical Center, New York, New York 10029, USA.  
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# Concomitant tricuspid repair rates

## Mayo Clinic

## Mount Sinai

Acquired Cardiovascular Disease

Yilmaz et al

### Functional tricuspid regurgitation at the time of mitral valve repair for degenerative leaflet prolapse: The case for a selective approach

Opaz Yilmaz, MD,\* Rakesh M. Suri, MD, DPhil,<sup>1</sup> Joseph A. Deamari, MD,<sup>2</sup> Thoralf M. Sundt III, MD,<sup>1</sup> Richard C. Daly, MD,<sup>2</sup> Harold M. Burkhart, MD,<sup>2</sup> Zhao Li, MS,<sup>2</sup> Maurice Enriquez-Sarano, MD,<sup>2</sup> and Harrell V. Schaff, MD<sup>1</sup>

**Objective:** It is not clear whether clinically silent tricuspid valve regurgitation should be addressed at the time of mitral valve repair for severe mitral regurgitation due to leaflet prolapse. We examined the clinical and echocardiographic outcomes of patients with tricuspid regurgitation who underwent only mitral valve repair.

**Methods:** We retrospectively analyzed records of patients undergoing mitral valve repair for isolated mitral valve prolapse who had concomitant tricuspid valve regurgitation during an 11-year period at our institution. Echocardiographic data were compared preoperatively, intraoperatively, and postoperatively at less than 1, 1 to 3, 3 to 5, and more than 5 years.

**Results:** In 699 patients who underwent mitral valve repair, 100 (14%) had severe tricuspid regurgitation, mean age was 68 ± 4 years and 65% (65/100) were female. Preoperative tricuspid valve regurgitation was grade 1 or 2 for most in 115 (16%) patients and less than grade 1 in 85 (12%) patients. After mitral valve repair, overall grade of tricuspid valve regurgitation decreased significantly within the first year ( $P < .01$ ). In patients with grade 3 regurgitation or more, the grade decreased at dismissal and until the third year ( $P < .001$ ). Female sex, preoperative atrial fibrillation, and diabetes mellitus were independent risk factors for increased tricuspid valve regurgitation with time. Preoperative regurgitation of grade 3 or more independently predicted decreased grade with time. Only 1 patient required tricuspid reoperation 4.5 years after mitral repair.

**Conclusions:** Clinically silent moderate tricuspid valve regurgitation in patients with degenerative mitral valve disease is unlikely to progress after mitral valve repair. Tricuspid valve surgery is rarely necessary for most patients undergoing repair of isolated mitral valve prolapse. (J Thorac Cardiovasc Surg 2012;144:608-13)

Functional tricuspid valve regurgitation (TR) is common in patients with left-sided cardiac valve disease.<sup>1,2</sup> Although early reports suggested that TR may resolve after the diseased mitral valve (MV) is replaced,<sup>3</sup> subsequent data have shown that severe TR may develop late after MV surgery for rheumatic or ischemic disease, even in the absence of significant residual mitral stenosis, regurgitation, or other causes of left-sided heart failure.<sup>4-7</sup> Severe symptomatic residual TR compromises long-term outcomes after MV surgery and is associated with increased early and mid-term mortality and mortality despite adequate MV correction.<sup>8-10</sup> However, previous studies have focused mainly on patients with ischemic, rheumatic, or mitral leaflet disease undergoing MV replacement,<sup>11</sup> and their conclusions

cannot be readily extended to patients undergoing isolated repair for degenerative MV disease. Specifically, few data have addressed the progression of clinically silent, functional TR and the need for reoperation after repair of mitral leaflet prolapse. It is therefore unclear whether the tricuspid valve (TV) should be addressed at the time of isolated MV repair. We analyzed the clinical and echocardiographic outcomes of patients with clinically significant functional TR in whom only MV repair was performed.

**PATIENTS AND METHODS**  
We searched our prospective patient database for the records of patients who underwent MV repair for isolated MV prolapse and who had concomitant, clinically silent, low-to-mild TR before January 1, 1995, and January 1, 2006, at Mayo Clinic, Rochester, Minnesota. The study was reviewed and approved by the Mayo Clinic Institutional Review Board. The need for bilateral patient consent was waived because patient identification was not included in the dataset. We excluded patients who died before admission to clinical research, who had concomitant coronary artery bypass grafting surgery, or who had other concomitant cardiac procedures other than closure of a patent foramen ovale. We also excluded patients with an initial diagnosis of MV regurgitation caused by congenital, rheumatic, or ischemic leaflet disease or cardiomyopathy and those with endocarditis, aortic leaflet disease, or valvular disease. Patients with primary pulmonary disease, significant right ventricular dysfunction, or chronic TV abnormalities (including annular) were also not included. Fifty-seven patients who had TR associated with right heart failure

From the Division of Cardiovascular Surgery,<sup>1</sup> Memorial Sloan-Kettering Cancer Center, and Cardiovascular Research,<sup>2</sup> Mount Sinai, New York, New York. Received October 10, 2011; revised manuscript received January 10, 2012; accepted for publication February 22, 2012. Address correspondence to Dr. Yilmaz at the address above. Reprints requests to Dr. Yilmaz at the address above. © 2012 American Association for Thoracic Surgery. 0885-0666/12/144-608-06\$36.00/0

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DOI: 10.1016/j.jtcvs.2012.03.002

Applied Cardiovascular Disease

Castillo et al

### A near 100% repair rate for mitral valve prolapse is achievable in a reference center: Implications for future guidelines

Javier G. Castiella, MD, Aneluchi C. Anyanwu, MD, Valentin Fuster, MD, PhD, and David H. Adams, MD

**Background:** Although mitral valve repair is the recommended treatment for severe mitral regurgitation of degenerative etiology, valve replacement remains common, particularly for complex lesions or annular leaflet involvement. We sought to characterize the feasibility and outcomes of an “all-comers” repair strategy applied systematically in all cases of degenerative mitral valve disease, regardless of age, complexity, or leaflet involvement.

**Methods:** From January 2002 to December 2010, 754 consecutive patients (mean age, 58 ± 13 years [range, 12-90]; mean LVSD, 55%) underwent mitral valve repair for degenerative mitral valve prolapse (annular leaflet) (n = 42, 4%), posterior leaflet prolapse (n = 106, 14%), anterior leaflet prolapse (n = 606, 82%) mitral valve surgery. Annular, leaflet or chordal calcification was present in 27% of patients.

**Results:** All patients were treated with a repair strategy that included annular repair with a median ring size of 32 mm (interquartile range, 28-36 mm) and leaflet repair with a repair rate of 97% due to annular calcification, gross bleeding, and 5 times to repair 30% (n = 5) due to disease progression or infective endocarditis. In-hospital mortality and major stroke rates were 0.8% and 0.5%, respectively. Survival rates at 1 and 5 years were 90.2%, 81.8%, and 87.4%, 74.0%, respectively. Seven-year freedom from reoperation was 97.4%, 8.6%, 0.6%. The estimate of patients with <30-mitral regurgitation at 1 and 7 years was 88% and 95%, respectively, and 93% and 91%, respectively, for <2+ mitral regurgitation.

**Conclusions:** A systematic strategy of mitral valve repair that uses a variety of techniques allows repair of all degenerative lesions in a reference center with good short-term outcomes and mid-term durability. Further study is required to document the long-term efficacy of an “all-comers” mitral valve repair strategy in degenerative subgroups with very complex valve morphology. (J Thorac Cardiovasc Surg 2012;144:608-12)

Single mitral valve repair is the gold standard procedure for patients who require surgery for degenerative mitral valve regurgitation. The American College of Cardiology and American Heart Association guidelines for the management of patients with valvular heart disease require targeted referral to “reference centers” to ensure that a repair rate of at least 90% is achieved, especially those patients who are asymptomatic.<sup>1</sup> Although simple posterior leaflet prolapse is associated with very high mitral valve repair rates in many centers,<sup>2,3</sup> the overall repair rate for more complex anatomy, as defined by leaflet involvement (eg, anterior or bi-leaflet), leaflet complexity (eg, significant annular calcification, giant excess leaflet), or patient comorbidities (eg,

older age, hypertension),<sup>4</sup> remains less well established and appears to be well below the guideline-recommended 90%. It should, as has previously existing on average mitral valve repair rate of approximately 70% observed in the Society of Thoracic Surgeons database.<sup>5</sup> We report our experience with a “repair for all comers” strategy in a consecutive series of patients referred for degenerative mitral valve surgery, regardless of complexity or postoperative characteristics.

**MATERIALS AND METHODS**  
**Study Population**  
We retrospectively identified a total of 754 consecutive patients with degenerative mitral valve prolapse operated for mitral regurgitation as the primary indication by a high-volume (Cleveland) and low-volume (New York) tertiary care centers. The Cleveland study population was identified in all patients by echocardiographic studies before the operative evaluation. These were not included for analysis if they were operated on with a leaflet disease or fibrotic leaflet prolapse, or if there was an annular or anterior leaflet prolapse, chordal or leaflet prolapse without significant degeneration. Of the 754 patients included, 576 (75%) had isolated posterior leaflet prolapse, 127 (17%) had isolated anterior leaflet prolapse, and 151 (19%) had bi-leaflet and chordal prolapse. Demographic, clinical, and echocardiographic characteristics are summarized in Table 1. Mean patient age was 58 ± 13 years (range, 12-90 years). One hundred fifty-eight patients (20%) were female. Mean preoperative regurgitation grade was 3.0% ± 1%, and 60% of patients (373) were from New York State Association Hospital data. Of 671 patients, mitral regurgitation grade 3 or more was repaired completely by leaflet reconstruction, was moderately severe in 48 patients (7.1%) and severe in the remaining 68 (10.1%).

From the Department of Cardiovascular Surgery, The Mount Sinai School of Medicine, New York, NY. Received October 10, 2011; revised manuscript received January 10, 2012; accepted for publication February 22, 2012. Address correspondence to Dr. Castiella at the address above. Reprints requests to Dr. Castiella at the address above. © 2012 American Association for Thoracic Surgery. 0885-0666/12/144-608-06\$36.00/0

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Yilmaz O et al 2011; JTCVS 142: 608-13  
Castillo JG, Anyanwu AC, Fuster VF et al, 2012; JTCVS 144: 308

# STS and EAC S meet in Latin America

# Why is so important to know the history ???

In patients with **primary TV disease**, **TV repair is associated with better early, mid-term, and event-free survival than TV replacement** (5 years at 90% vs 63%; 10 years at 76% vs 55%;  $P < 0.001$ ). Moderate to severe RV dysfunction was significantly lower in the TV repair group (repair, 9%; replacement, 28%).

However, in patients with **combined TV and MV disease**, Moraca et al. found no difference in survival benefits between TV repair and replacement. **In the propensity-matched study, operative mortality was similar (both high) for TV repair and replacement (18% vs 13%), and late survival was similar (5 years at 72% vs 79%; 10 years at 66% vs 49%).**

Other investigations also demonstrated **no difference between procedures, despite a higher incidence of preoperative TR severity and risk factors in the TV replacement group**. The incidence of redo TV surgeries was not significantly different between groups.

Moraca RJ, Moon MR, Lawton JS, et al. Outcomes of tricuspid valve repair and replacement: a propensity analysis. *Ann Thorac Surg.* 2009;87:83–88.



# Why is so important to know the history ???

Determining **which of the current repair procedures provide the best long-term outcomes are necessary**, in particular for those patients with severe tricuspid tethering (RHF- dilatation).

Investigations of adjunctive or other repair techniques are warranted or the use of chord-sparing TV replacement.



Patrick M. McCarthy, 2010

# Why is so important to know the history ???

Surgical treatment of tricuspid valve disease, regardless of the operative approach, is associated with significant early and late mortality. However, there is no difference favoring tricuspid valve repair over replacement. Thus, **we should not hesitate to consider tricuspid valve replacement** for patients in whom we believe there is a reasonable chance for recurrence of regurgitation after repair.

Moraca RJ, Moon MR, Lawton JS, et al. Outcomes of tricuspid valve repair and replacement: a propensity analysis. *Ann Thorac Surg.* 2009;87:83–88.



# Repairing the mitral and the tricuspid is a good deal



STS and EACTS meet in Latin América

# Why Isolated TV surgery is less common?

## Primary (Organic) 20%

- Rheumatic
- Myxomatous
- Endocarditis
- Carcinoid disease
- Ebstein anomaly
- Endomyocardial fibrosis
- Traumatic
- Iatrogenic

Circulation.2009;119:2719-2725

## Secondary (functional) 80 %

- Left heart valvular disease
- Pulmonary hypertension
- Primary RV dysfunction
- Volume overload due to intracardiac shunt

Current surgical volume of TV surgery in the STS Database represents only about one-tenth of the >40 000 mitral valve operations performed yearly in the United States.





# Severe secondary tricuspid regurgitation

End stage RV dilatation  
Tricuspid leaflets severe tethering

## Undersized Tricuspid Annuloplasty Rings Optimally Treat Functional Tricuspid Regurgitation

Mehrdad Ghoreishi, MD, Jamie M. Brown, MD, Craig E. Stauffer, BS, Cindi A. Young, Mary J. Byron, PA-C, Bartley P. Griffith, MD, and James S. Gammie, MD

Division of Cardiac Surgery, University of Maryland Medical Center, Baltimore, Maryland

**Background.** In contrast to mitral valve repair, residual and recurrent regurgitation after tricuspid valve (TV) repair for functional tricuspid regurgitation (TR) is common. We have systematically used undersized, rigid 3-dimensional annuloplasty rings to treat functional TR.

**Methods.** From March 2006 to October 2009, 101 consecutive patients with moderate or greater functional TR underwent TV repair with an undersized rigid 3-dimensional annuloplasty ring. All patients had a pre-discharge echocardiography evaluation in a core echocardiography laboratory. Follow-up echocardiography was available for 96% of surviving patients. Mean follow-up was  $17 \pm 9$  months.

**Results.** Twenty-nine percent of patients had undergone previous cardiac operations, 74% were in New York Heart Association functional class III or IV, and 48% had atrial fibrillation. Mitral valve operations were performed in 93 patients, aortic valve operations in 17,

coronary artery bypass grafting in 21, and CryoMaze procedures in 40. Size 26 or 28 rigid tricuspid annuloplasty rings were used in 88% of patients, and no ring larger than a 28 has been used since November 2008. The operative mortality rate was 6% ( $n = 6$ ). Freedom from significant TR (TR > moderate) at hospital discharge, as assessed by the clinical core laboratory, was 97%. Only 3% of patients had TR greater than moderate during follow-up. No patient required TV reoperation. New postoperative permanent pacemakers were inserted in 3 patients.

**Conclusions.** Tricuspid valve repair with an undersized (size 26 or 28) rigid 3-dimensional annuloplasty ring is the method of choice for reliable and durable treatment of functional TR.


(Ann Thorac Surg 2011;92:89–96)

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# Severe secondary tricuspid regurgitation

End stage RV dilatation  
Tricuspid leaflets severe tethering

  
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European Journal of Cardio-thoracic Surgery 34 (2008) 908–910

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SURGERY

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How-to-do-it

Tricuspid leaflet augmentation to address severe tethering in functional tricuspid regurgitation

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<sup>a</sup>Department of Cardiac Surgery, Royal Brompton and Harefield NHS Trust, Harefield Hospital, Hill End Road, Harefield, Middlesex UB9 6JH, United Kingdom

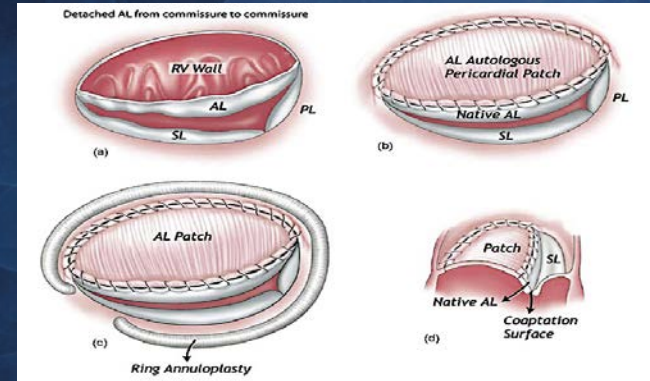
<sup>b</sup>Department of Cardiovascular Sciences, Imperial College London, United Kingdom

Received 24 April 2008; received in revised form 25 June 2008; accepted 1 July 2008; Available online 9 August 2008

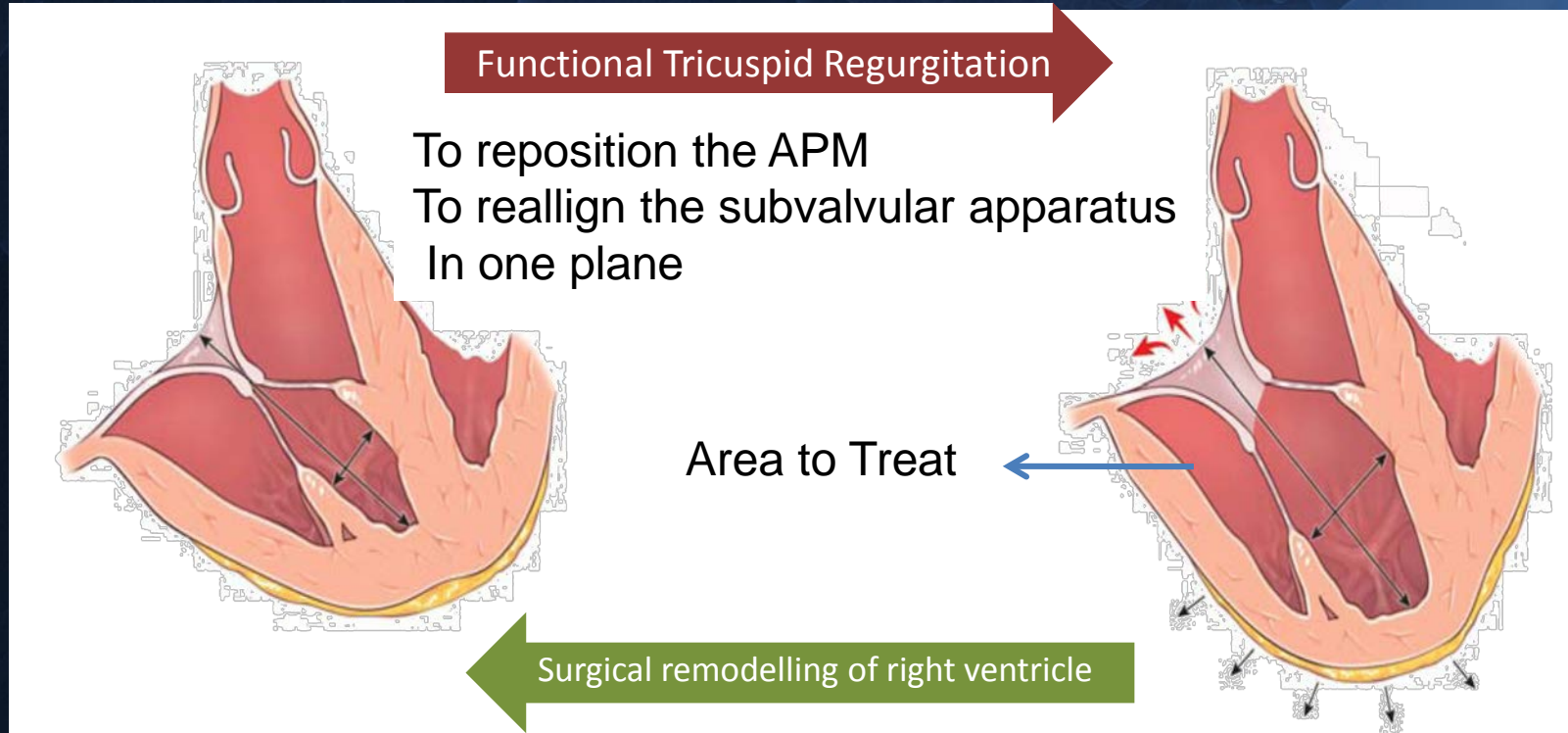
**Abstract**

This paper describes a technique for treating severe tricuspid regurgitation due to severe tethering of the tricuspid valve leaflets. The anterior tricuspid leaflet is augmented by use of an autologous pericardial patch, which increases its size, and hence its surface area of coaptation, allowing increased leaflet coaptation to occur with reduced tension within the right ventricle. A Carpentier–Edwards annuloplasty ring is then implanted. We have successfully performed this operation in 15 patients with severe tricuspid regurgitation due to severe leaflet tethering and have achieved complete elimination of tricuspid regurgitation with good coaptation of the tricuspid leaflets. We describe this simple and easily reproducible technique to treat severe tricuspid regurgitation due to tethering of the tricuspid valve leaflets.

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# Septalization of APM + annuloplasty to reverse the physiopatological FTR mechanism?



Jean-Paul Couetil, MD Henri Mondor Hospital, Creteil, France

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# Is repair always better ?

## Tricuspid Valve Replacement vs. Repair in Severe Tricuspid Regurgitation

---

Hyoung Woo Chang, MD, PhD; Dong Seop Jeong, MD, PhD;  
Yang Hyun Cho, MD, PhD; Kiick Sung, MD, PhD; Wook Sung Kim, MD, PhD;  
Young Tak Lee, MD, PhD; Pyo Won Park, MD, PhD

Compared with TVr, TVR had acceptable early and late outcomes in patients with severe TR. **TVR can be considered as a valid option with acceptable clinical outcomes in patients who are not suitable candidates for TVr.**

Circ J 2017; 81: 330 – 338

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# Their conclusions

Compared with TVr, **TVR was not a risk factor for early or long-term outcomes in patients with severe TR**. Even with several disadvantageous preoperative characteristics such as longer CPB time, more complex concomitant procedures, and higher proportion of previous cardiac surgeries, **TVR was equivalent to TVr in outcomes**

In order to prevent TR recurrence, ring annuloplasty is strongly recommended in TVr procedures. **TVR is still a valid option when the tricuspid valve has hostile pathology or the patient is in a critical condition.**

Circ J 2017; 81: 330 – 338



Why is so important to know the history ???

TVR is better option than **inadequate** TV  
repair

Dr. Karliova, Homburg



# Why TV Replacement is less common?

## Primary (Organic) 20%

- Rheumatic
- Myxomatous
- Endocarditis
- Carcinoid disease
- Ebstein anomaly
- Endomyocardial fibrosis
- Traumatic
- Iatrogenic

Circulation.2009;119:2719-2725

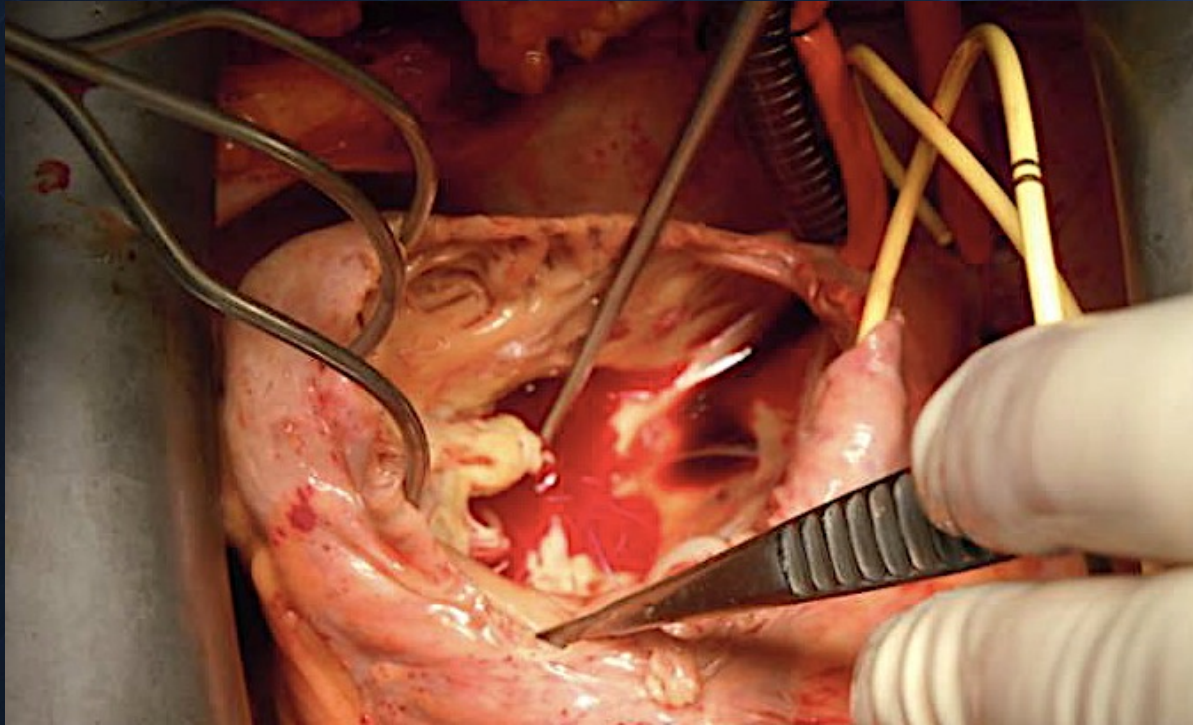
## Secondary (functional) 80 %

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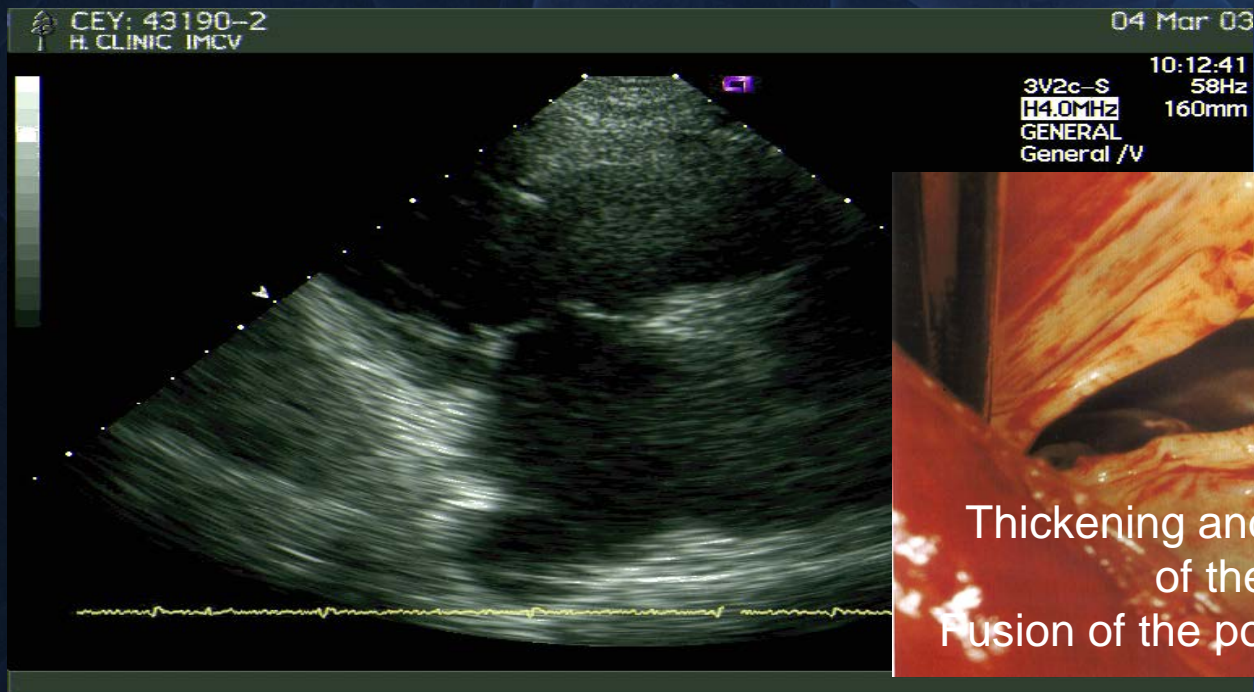
# Severe organic tricuspid regurgitation



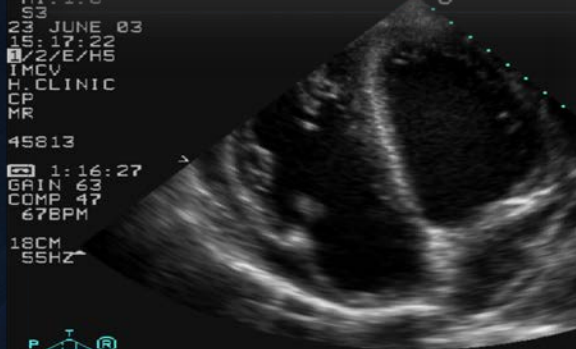
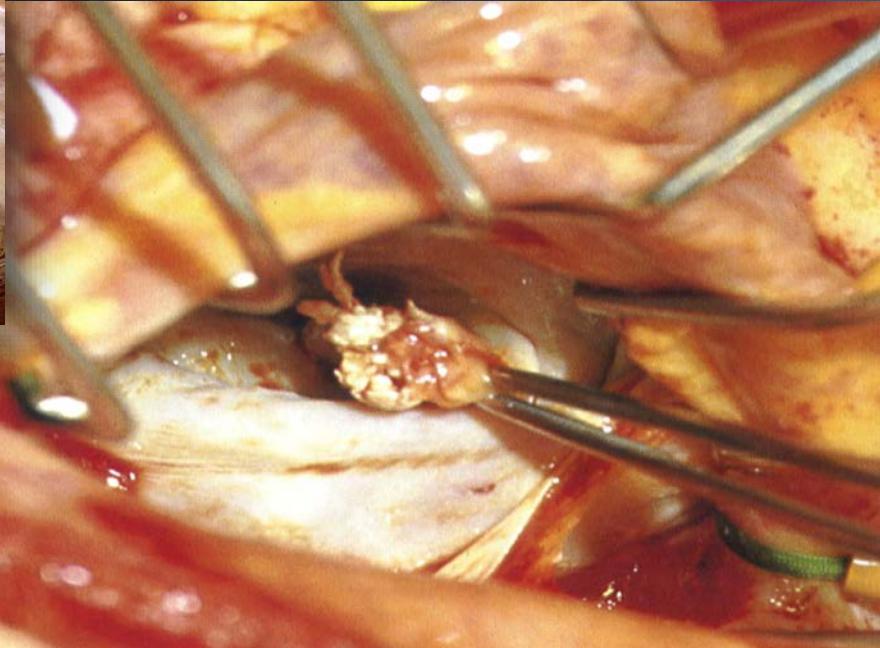
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# Rheumatic TR



# Infective Tricuspid Endocarditis



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# Infective Tricuspid Endocarditis in Addicts to drugs

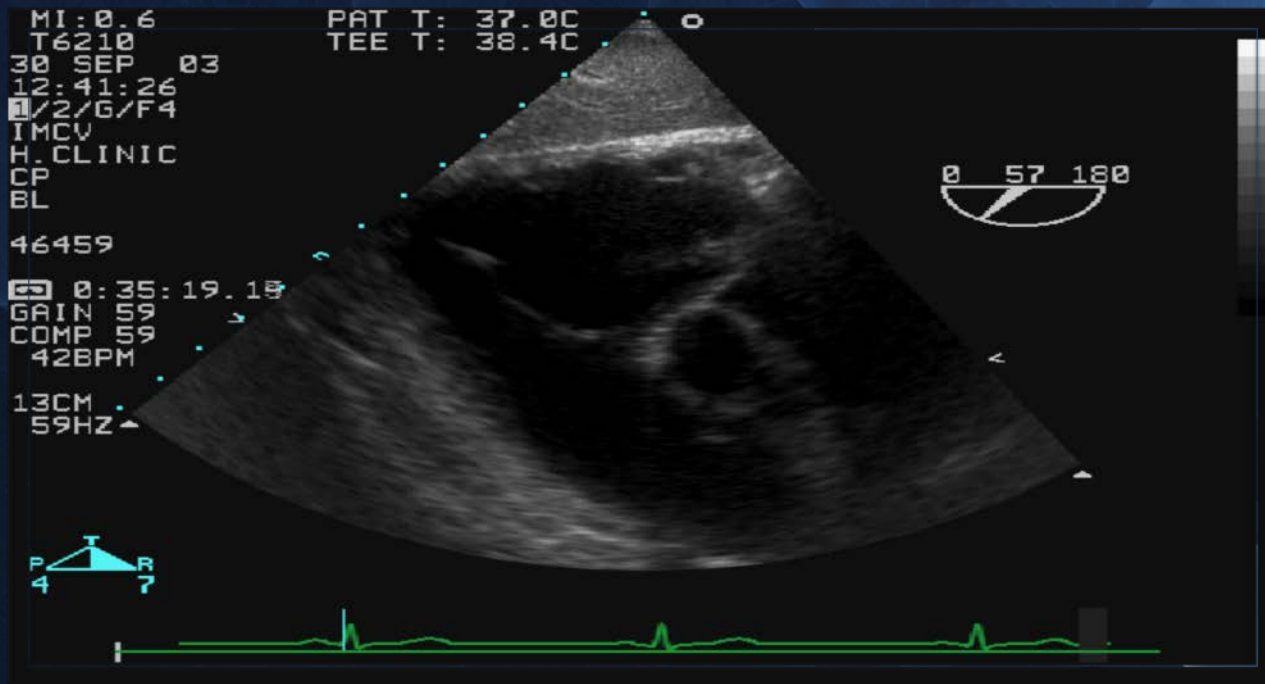
Tricuspid valve replacement using a mitral homograft:  
surgical technique and initial results.

Pomar JL, Mestres CA.

J Heart Valve Dis.1993;2:125–8.



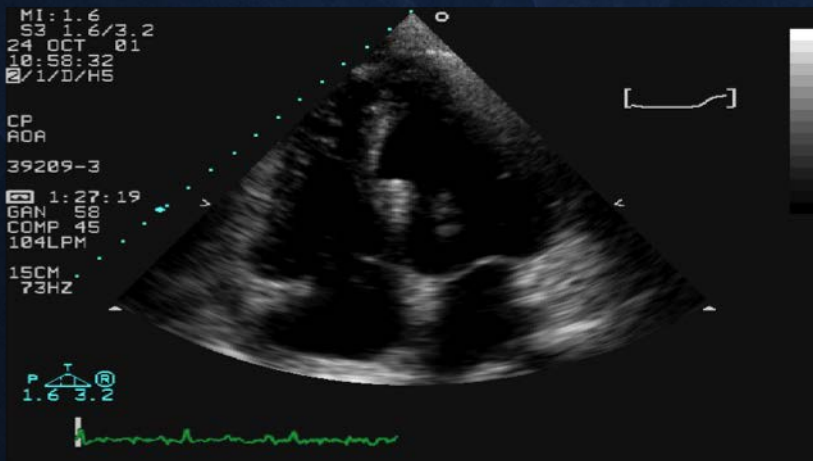
# Tricuspid tumors



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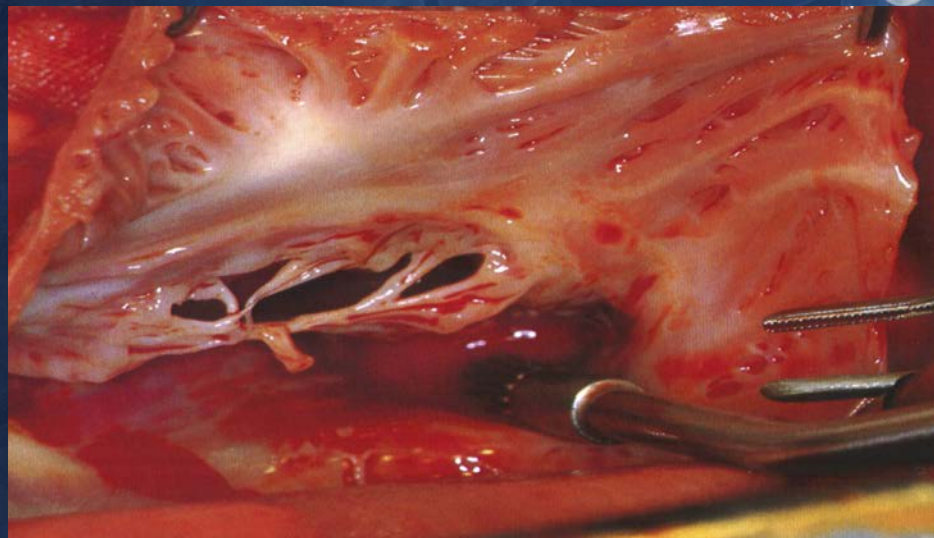


# Tricuspid traumatism

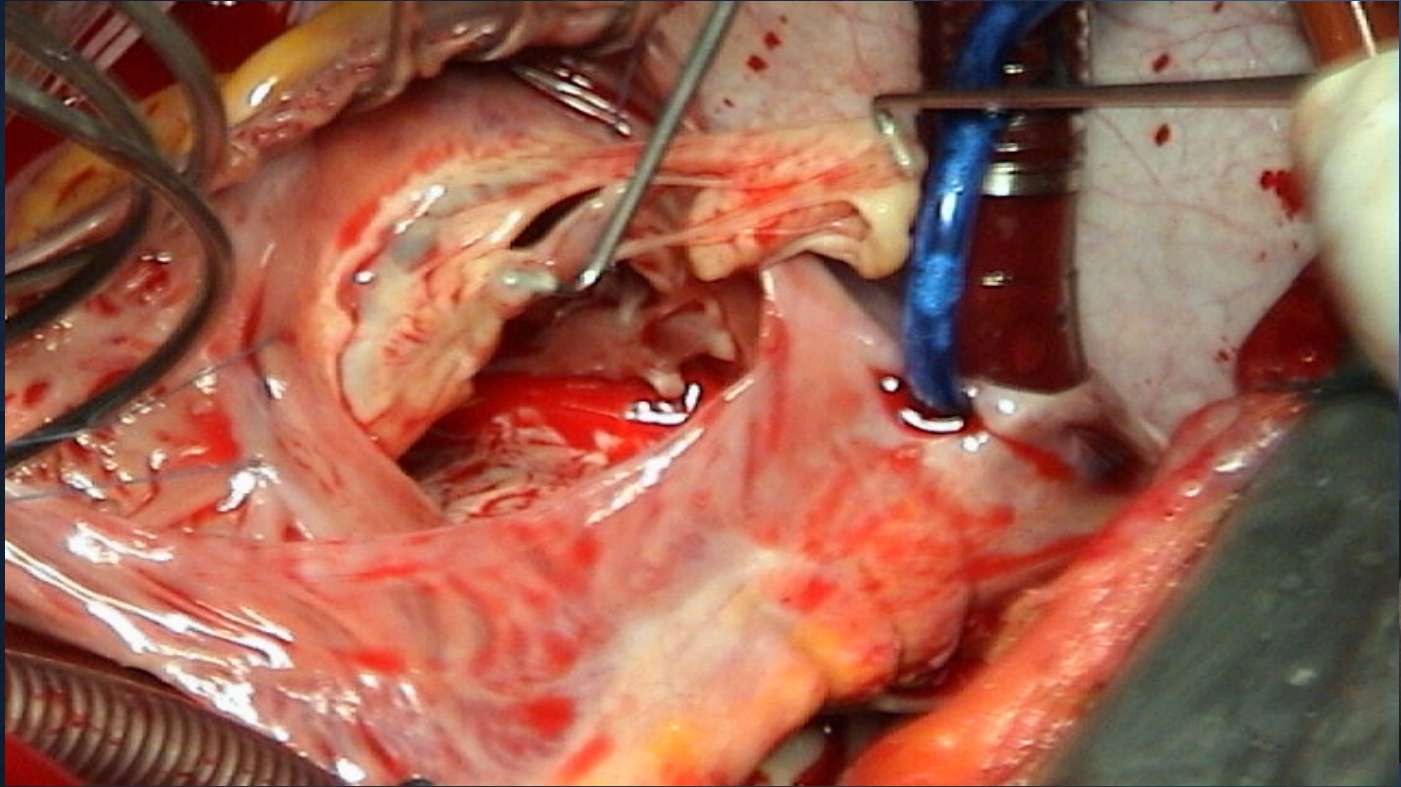


Prolapse of the anterior leaflet

Chordal rupture of the anterior and posterior leaflets

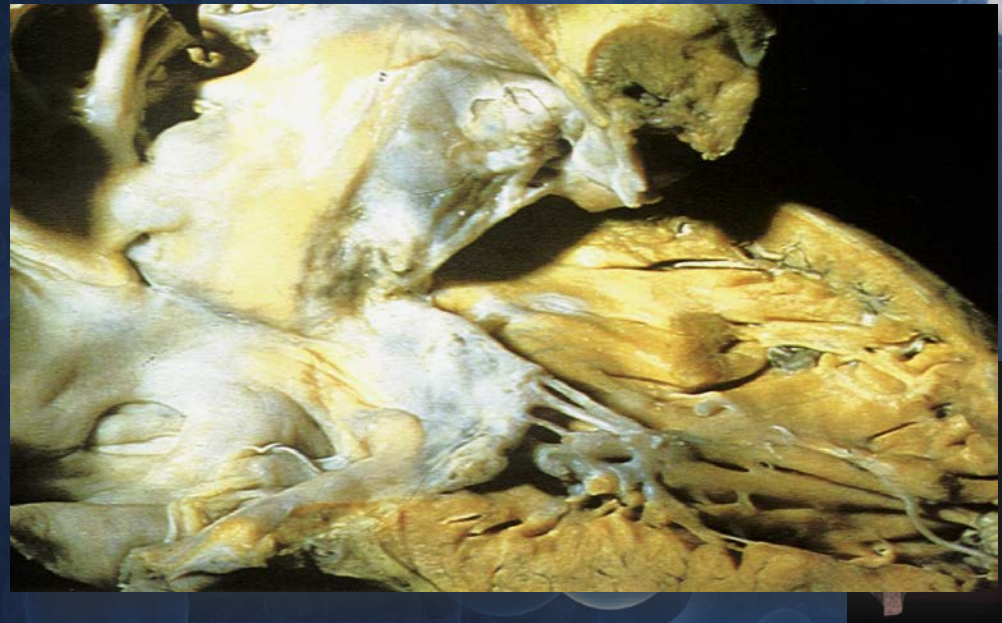
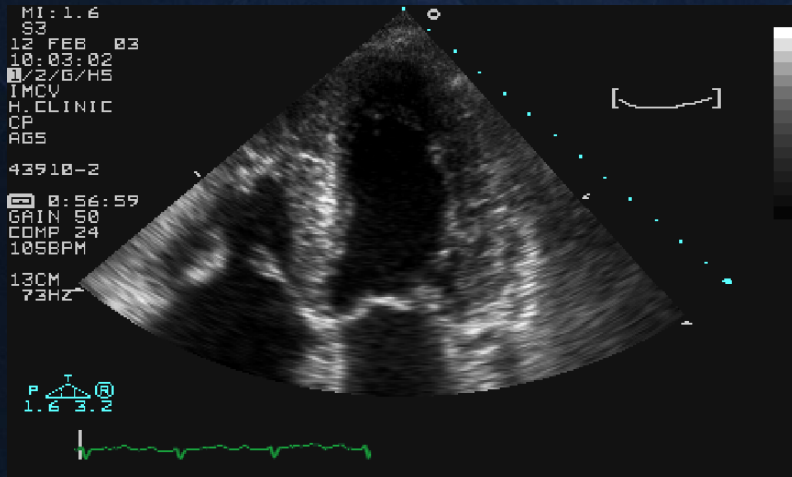


# Tricuspid traumas: chordal rupture



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# Carcinoid and obesity drugs

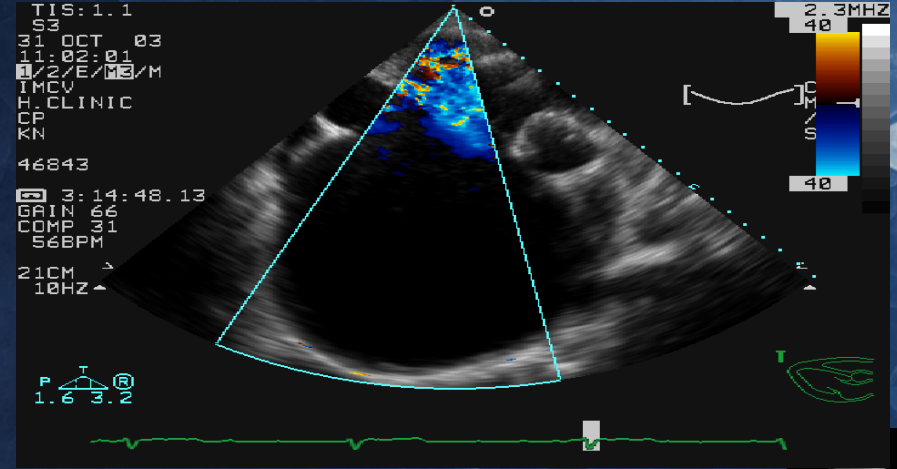
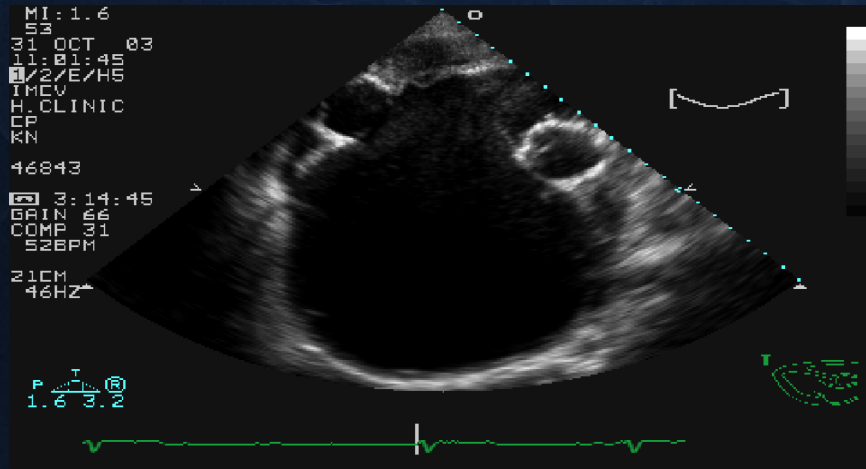


Callahan et al. Am Heart J. 1982;50:762

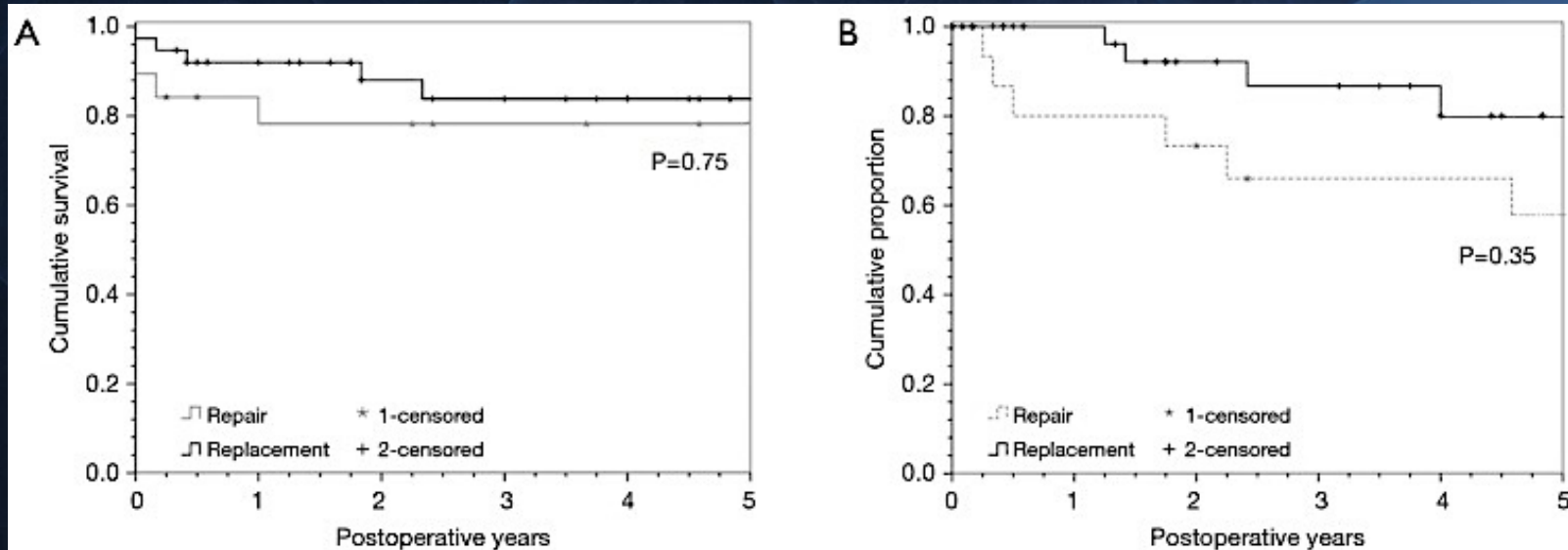
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# Endomyocardial fibrosis



# Repair vs replacement in isolated TVReg



Survival curves for the entire cohort. (A) Showing overall postoperative survival between isolated tricuspid valve repair and replacement; (B) composite proportion of patients without return of moderate/severe TR/RH failure or TV reoperation.

**Surgical outcomes of isolated tricuspid valve procedures: repair versus replacement** Julius I. Ejiofor, Robert C. Neely, Maroun Yammine, Siobhan McGurk, Tsuyoshi Kaneko, Marzia Leacche, Lawrence H. Cohn, and Prem S. Shekar



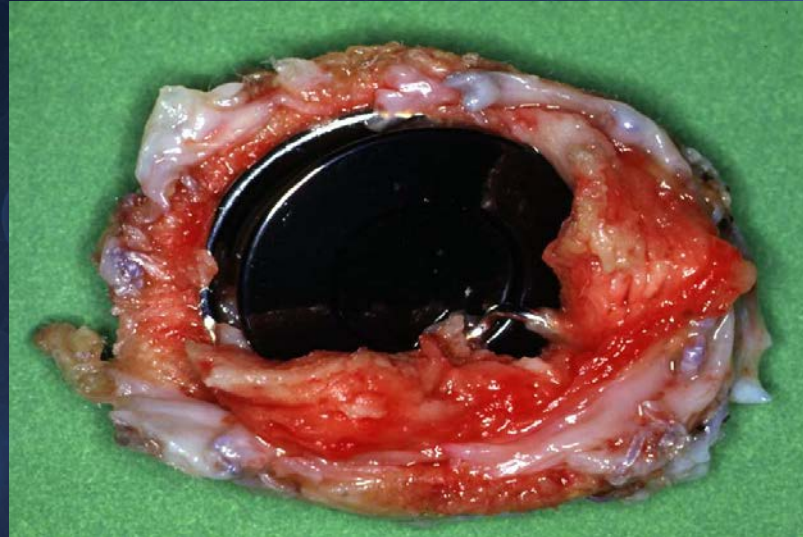
# Choosing the substitute

Provided we need to replace the tricuspid valve:

Is it better a bioprosthesis or a mechanical device?



# Mechanical, porcine, bovine for T Valve Replacement ?



Not a single manufacturer sells valve prostheses for tricuspid position



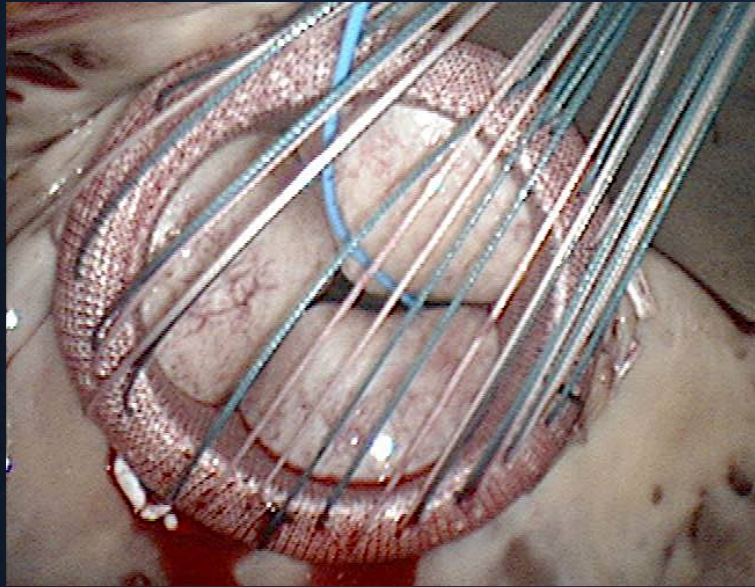
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# The biological prostheses in tricuspid

Closing the pericardial leaflets with a central orifice..  
Better to use porcine???

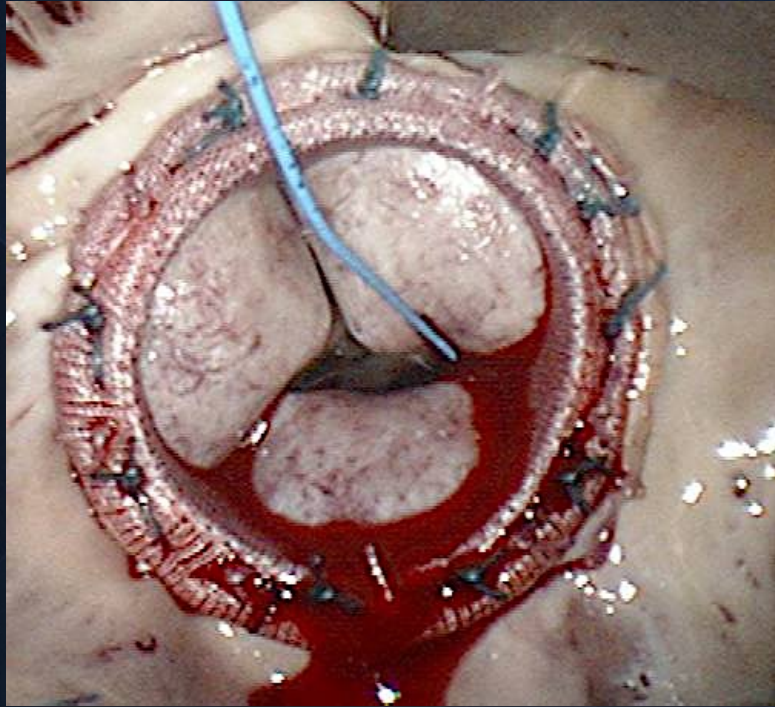


# Porcine vs bovine xenografts in the tricuspid?

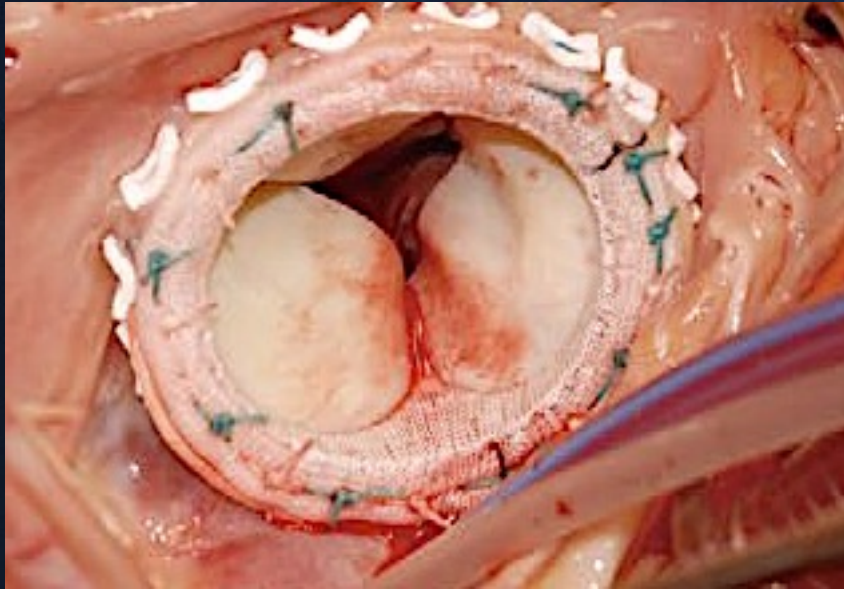


Resistance of the tissue, closing central orifice of bovine ?

# Dealing with the pacemaker's electrodes: **No electrodes**



# Tricuspid replacement: bioprosthetic or mechanical valve?



Asian Cardiovasc Thorac Ann. 2004 Jun;12(2):143-8

There **was no significant difference** in performance so as to recommend one type over the other, but bioprosthetic valves may be more favorable as they failure is more predictable

N.A. Solomon





# Tricuspid Valve Replacement, Mechanical vs. Biological Valve, Which one Is better?

The patients who require tricuspid valve replacement are usually high risk surgical candidates with early and long term mortality.

The findings of the current study **showed no significant hemodynamic difference** between mechanical and biological valves

Altaani HA, Jaber S. Tricuspid Valve Replacement, Mechanical vs. Biological Valve, Which Is Better? Int Cardiovasc Res J.2013;7(2): 71-4.10289



## When should a mechanical tricuspid valve replacement be considered?

Sameh M. Said, MD,<sup>a</sup> Harold M. Burkhart, MD,<sup>a</sup> Hartzell V. Schaff, MD,<sup>a</sup> Jonathan N. Johnson, MD,<sup>b</sup> Heidi M. Connolly, MD,<sup>c</sup> and Joseph A. Dearani, MD<sup>a</sup>

Isolated mechanical TVR still leads to increased early mortality. **A mechanical valve can be considered in select situations when anticoagulation is necessary and in the presence of good right ventricular function.**

J Thorac Cardiovasc Surg 2014;148:603-8



## When should a mechanical tricuspid valve replacement be considered?

Sameh M. Said, MD,<sup>a</sup> Harold M. Burkhart, MD,<sup>a</sup> Hartzell V. Schaff, MD,<sup>a</sup> Jonathan N. Johnson, MD,<sup>b</sup> Heidi M. Connolly, MD,<sup>c</sup> and Joseph A. Dearani, MD<sup>a</sup>

TVR with a mechanical prosthesis still has its place and indications. The long-term outcome is satisfactory, with good durability and excellent freedom from reoperation.

Our preference is a low profile bileaflet mechanical prosthesis

J Thorac Cardiovasc Surg 2014;148:603-8



# Mechanical Tricuspid Valve Replacement Is Not Superior in Patients Younger Than 65 Years Who Need Long-Term Anticoagulation

Ho Young Hwang, MD, PhD, Kyung-Hwan Kim, MD, PhD, Ki-Bong Kim, MD, PhD, and Hyuk Ahn, MD, PhD

Department of Thoracic and Cardiovascular Surgery, Seoul National University Hospital, Seoul, Republic of Korea

Even in younger patients who need anticoagulation therapy irrespective of TVR, **mechanical TVR is not superior** because of increased occurrence of valve-related events, especially the composite of thrombosis, embolism, and bleeding, **although there is no difference in overall survival** between mechanical and bioprosthetic TVRs.

Ann Thorac Surg 2012;93:1154–61

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# CONCLUSIONS AT THE END

1. **Isolated Tricuspid Valve** surgery is getting lower hospital mortality and therefore, early indication is recommended
2. **Tricuspid pathology, severity (what de hell moderate TR is?) symptoms and RVFunction** will advice proper timing
3. Appropriate repair is the ideal offer for most patients

However...



# CONCLUSIONS TODAY

**Valve replacement** is not a disaster: many TV patients evolve well after getting a prostheses

If the repair will be imperfect, **consider replacement**

**Bioprostheses** are my favourite if no OAC required

Patients needing **OAC** may benefit of a **mechanical** device

**Intrinsic failure** uses to be benign on bioprostheses. Elective vs emergency surgery makes a huge difference...

Forget the **myths and what “every body says”** and have your own opinion in those unusual cases.

