

# **Leaks paravalvolari**

## **Cenni di riparazione chirurgica**

# ...di cosa stiamo parlando?

## LEAKs PARAVOLVOLARI:

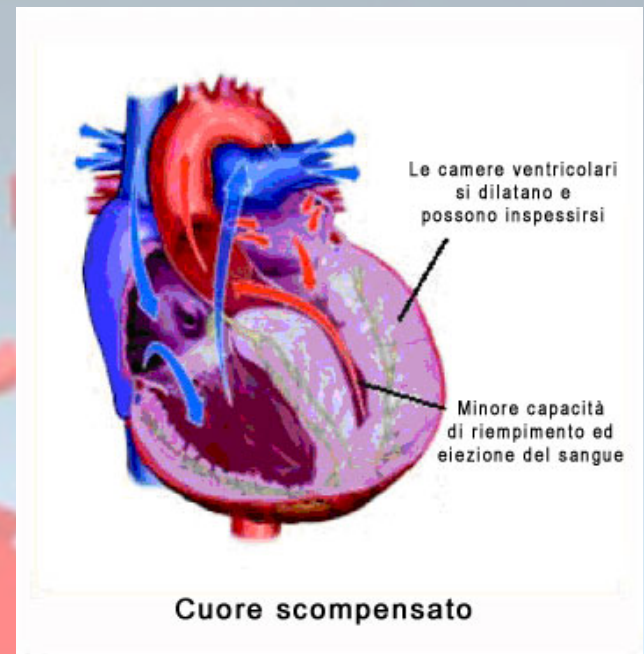
- Comunicazione anomala tra camere cardiache adiacenti ad una valvola protesica
- Complicanza relativamente poco comune, ma...

...attenzione alle conseguenze!!



© Can Stock Photo

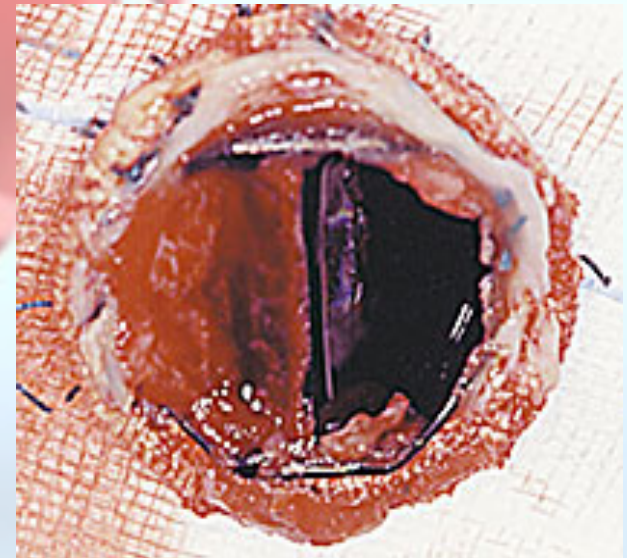
- **Scompenso cardiaco**



## **Endocardite infettiva**



## **Anemia emolitica**



Un po' di numeri...

# PREVALENZA:

## CARDIOVASCULAR MEDICINE

Prevalence and clinical significance of incidental paraprosthetic valvar regurgitation: a prospective study using transoesophageal echocardiography

A Ionescu, A G Fraser, E G Butchart

*Heart* 2003;**89**:1316-1321

✓ 2-10% su valvola aortica

✓ 7-17% su valvola mitrale

**Table 1** Prevalence of paraprosthetic jets at the early transoesophageal echocardiographic study by valve type and position

Prosthesis type	Paraprosthetic jets		Total
	Absent	Present	
<b>Aortic</b>			
Carpentier-Edwards	34	2 (6%)	36
Porcine	8	0	8
Medtronic Hall	74	1 (1%)	75
St Jude	105	11 (10%)	116
Ultracor	33	2 (6%)	35
<b>Total</b>	<b>254</b>	<b>16 (6%)</b>	<b>270</b>
<b>Mitral</b>			
Medtronic Hall	25	12 (32%)	37
St Jude	43	17 (28%)	60
Ultracor	10	9 (47%)	19
<b>Total</b>	<b>78</b>	<b>38 (33%)</b>	<b>116</b>

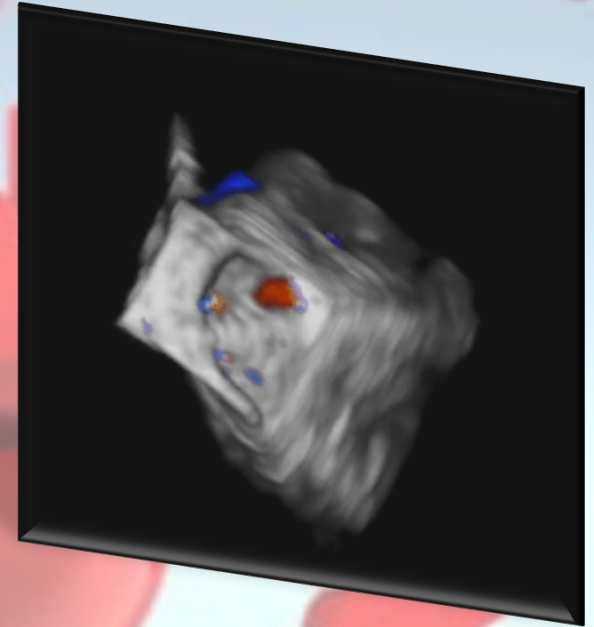
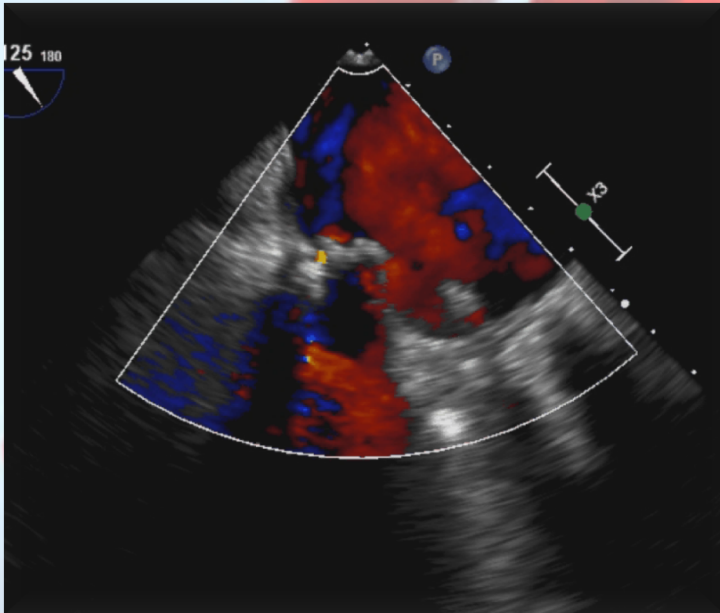
# COME



## STRATEGIE PER RICONOSCERE LA PRESENZA DI LEAK

1. Eco3D intraoperatorio

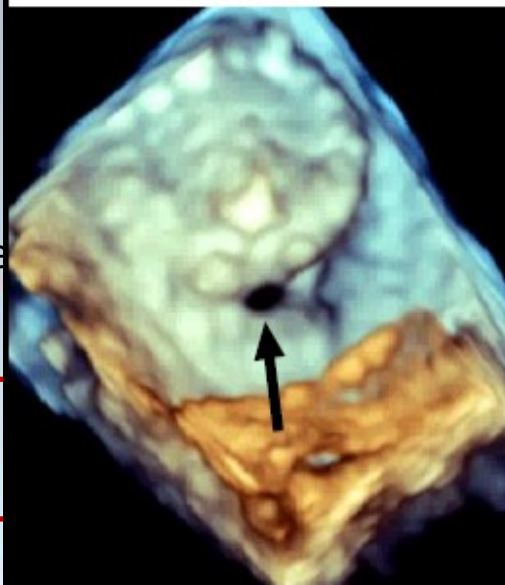
2. Eco2/3D TTE o TEE



1. Localizzazione

2. Dimensione

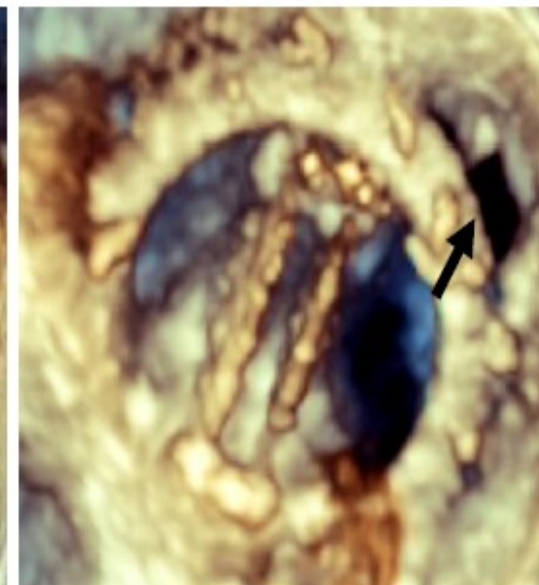
3. Forma



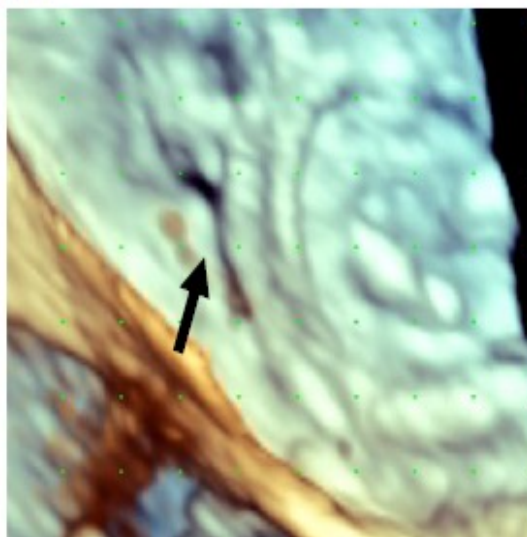
Round



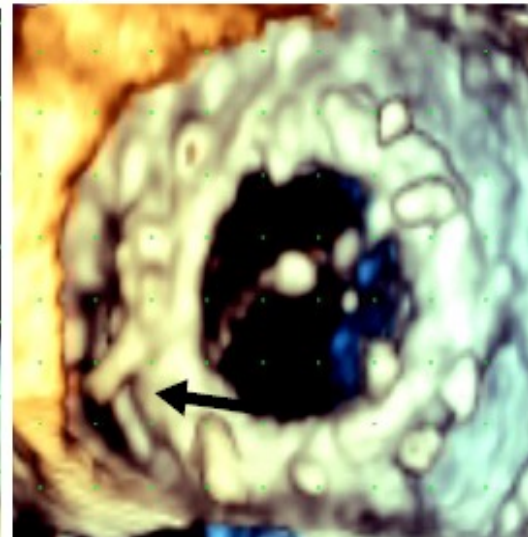
oval



crescentic



Slit-like



tunnel shaped PVL.

Crescentic cutting edge

# PERCHE'

## ***Incompleta apposizione dell'anello protesico all'annulus valvolare***



1. Calcificazioni annulari
2. Progresa infezione valvolare
3. Forma e dimensioni della protesi impiantata
4. Tecniche di sutura chirurgiche

### **Effect of Valve Suture Technique on Incidence of Paraprosthetic Regurgitation and 10-Year Survival**

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# QUANDO



La presenza di un leak può essere riconosciuta:

- ❖ Precocemente con l'ecoTE in sala operatoria → in questo caso il chirurgo può rapidamente intervenire con una revisione della procedura di sostituzione valvolare
- ❖ Tardivamente → in questo caso è necessaria una corretta valutazione dell'entità e della morfologia del rigurgito per stabilire in che modo intervenire per la sua correzione



**TERAPIA MEDICA**  
**VS**  
**TERAPIA CHIRURGICA**  
**VS**

**TRATTAMENTO PERCUTANEO**





# STRATEGIE TERAPEUTICHE



## Cosa dicono le linee guida?

### Management of haemolysis and paravalvular leak

Blood tests for haemolysis should be part of routine follow-up. Haptoglobin measurement is too sensitive and lactate dehydrogenase, although non-specific, is better related to the severity of haemolysis. The diagnosis of haemolytic anaemia requires TEE to detect a paravalvular leak (PVL). Only limited data are available regarding therapeutic options. There is a consensus to recommend reoperation if PVL is related to endocarditis or if PVL causes haemolysis needing repeated blood transfusions or leading to severe symptoms (Recommendation class I, Level of evidence C). In patients with haemolytic anaemia and PVL, where surgery is contraindicated, or those unwilling to undergo re-operation, medical therapy includes iron supplementation, beta-blockers, and erythropoietin if haemolysis is severe.<sup>210,211</sup> Percutaneous closure of PVL has only been the subject of isolated case reports and could not be considered so far as a validated alternative to surgery.



European Heart Journal (2012) 33, 2451–2496  
doi:10.1093/eurheartj/ehs109

ESC/EACTS GUIDELINES 

## Guidelines on the management of valvular heart disease (version 2012)

The Joint Task Force on the Management of Valvular Heart Disease of the European Society of Cardiology (ESC) and the European Association for Cardio-Thoracic Surgery (EACTS)

### **Dati relativamente scarsi relativi alle opzioni terapeutiche**

- **Il reintervento è mandatorio in caso di leak associato a**
  - **Endocardite infettiva**
  - **Ampio leak/distacco parziale**
  - **Protesi biologica con iniziali segni di degenerazione**



# STRATEGIE TERAPEUTICHE

## 2014 AHA/ACC Guideline for the Management of Patients With Valvular Heart Disease

### Prosthetic Valve Regurgitation

#### Class I

1. Surgery is recommended for operable patients with mechanical heart valves with intractable hemolysis or HF due to severe prosthetic or paraprosthetic regurgitation.

*(Level of Evidence: B)*

#### Class IIa

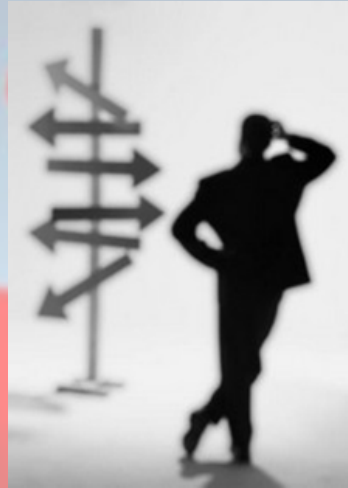
1. Surgery is reasonable for operable patients with severe symptomatic or asymptomatic bioprosthetic regurgitation.

*(Level of Evidence C)*

2. **Percutaneous repair** of paravalvular regurgitation is reasonable in patients with prosthetic heart valves and intractable hemolysis or NYHA class III/IV HF who are at high risk for surgery and have anatomic features suitable for catheter-based therapy when performed in centers with expertise in the procedure.

*(Level of Evidence B)*

Quale opzione terapeutica scegliere?



**CHIRURGIA**



**RIPARAZIONE  
PERCUTANEA**



Figura 1. Fotografia del Amplatzer vascolare Plug II.



# L'AVANZAMENTO DELLE TECNICHE PERCUTANEE

**Three-dimensional echocardiography-guided repair of severe paravalvular regurgitation in a bioprosthetic and mechanical mitral valve**

Amer M. Johri<sup>1\*</sup>, Kibar Yared<sup>1</sup>, Ronen Durst<sup>1</sup>, Roberto J. Cubeddu<sup>2</sup>, Igor F. Palacios<sup>2</sup>, Michael H. Picard<sup>1</sup>, and Jonathan Passeri<sup>1</sup>

**Transapical Repair of Mitral Valve Paravalvular Leakage Using 3-D Transesophageal Guidance**

Martin J. Swaans,<sup>\*</sup> MD, Martijn C. Post, MD, PhD, and Jurien M. ten Berg, MD, PhD

**Repair of paravalvular prosthetic mitral valve leaks with septal occluder devices in severely high-risk patients: a word of caution**

Craig R. Smith<sup>\*</sup>, Sotiris C. Stamou, William M. Merhi and Robert L. Hooker





# RISULTATI



## Review of surgical prosthetic paravalvular leaks: diagnosis and catheter-based closure

Author	Year	Location of PVL	Device	Number of patients	Number of defects	Technical success (%)
Hourihan et al. [9]	1992	Aortic valve	Double-umbrella Rashkind	4	4	75
Moore et al. [10]	2000	Mitral valve	Coils	1	1	100
Eisenhauer et al. [11]	2001	Mitral valve	Vascular occlusion device	1	1	100
Kort et al. [12]	2004	Mitral valve	Amplatzer duct occluder	1	1	100
Webb et al. [13]	2005	Aortic valve	Amplatzer duct occluder	1	1	100
Pate et al. [2]	2006	Mitral + aortic valve	Amplatzer duct occluder, Amplatzer septal occluder, coils	10	10	70
Hildick-Smith et al. [14]	2007	Aortic valve	Amplatzer mVSD occluder	1	1	100
Momplaisir and Matthews [15]	2007	Mitral valve	Amplatzer septal occluder	1	1	100
Shapira et al. [16]	2007	Mitral + aortic valve	Amplatzer occluder-various	11	13	85
Sorajja et al. [17]	2007	Mitral + aortic valve	Amplatzer septal occluder and Amplatzer duct occluder	16	19	89
Cortes et al. [18]	2008	Mitral valve	Amplatzer duct occluder	27	27	63
Kuehl et al. [19]	2009	Mitral valve	Amplatzer duct occluder	1	1	100
Hammerstingl et al. [20]	2009	Mitral valve	Amplatzer Vascular Plug III	1	1	100
Hammerstingl et al. [21]	2009	Aortic valve	Amplatzer Vascular Plug III	1	1	100
Kursaklioglu et al. [22]	2010	Mitral valve	Amplatzer duct occluder	1	1	100
Nietlispach et al. [23]	2010	Mitral + aortic valve	Amplatzer Vascular Plug III	5	5	100
Bogunovic et al. [24]	2011	Mitral valve	Amplatzer Vascular Plug III	1	1	100

# TRATTAMENTO CHIRURGICO: ARGOMENTO COMPLESSO (1)

*I re-interventi sono tecnicamente più complessi, rispetto al primo intervento chirurgico, a causa di:*

- 1. aderenze attorno al cuore,*
- 2. possibile aggravamento di altre concomitanti patologie cardiache,*
- 3. eventuali comorbidità del paziente.*

**Table 49–1.**

## Risk Factors for Reoperative Valve Surgery

Advanced age

Impaired ejection fraction (EF), congestive heart failure (CHF), or advanced preoperative functional class (NYHA)

Urgency of operation or unstable status preoperatively

Preoperative shock

Concomitant coronary artery bypass graft (CABG) or the presence of previous bypass grafts

Prosthetic valve endocarditis

Surgery for perivalvular leaks, valve thrombosis, or prosthetic dysfunction

Renal dysfunction

Chronic obstructive pulmonary disease (COPD)



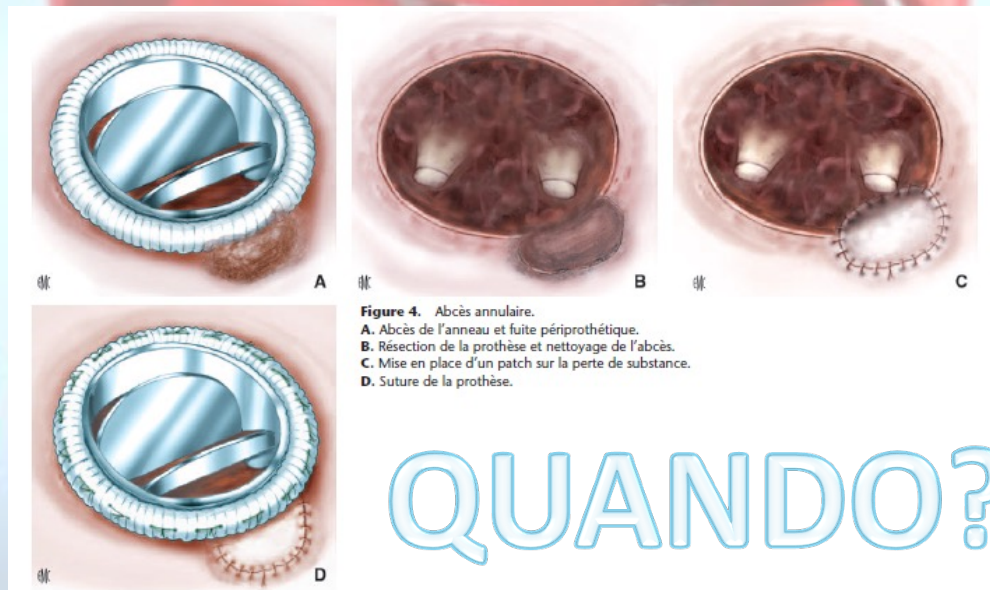
# TRATTAMENTO CHIRURGICO: ARGOMENTO COMPLESSO (2)

## ❑ Riparazione del leak

- In genere: suture interrotte (Tycron 2-0) su pledgets

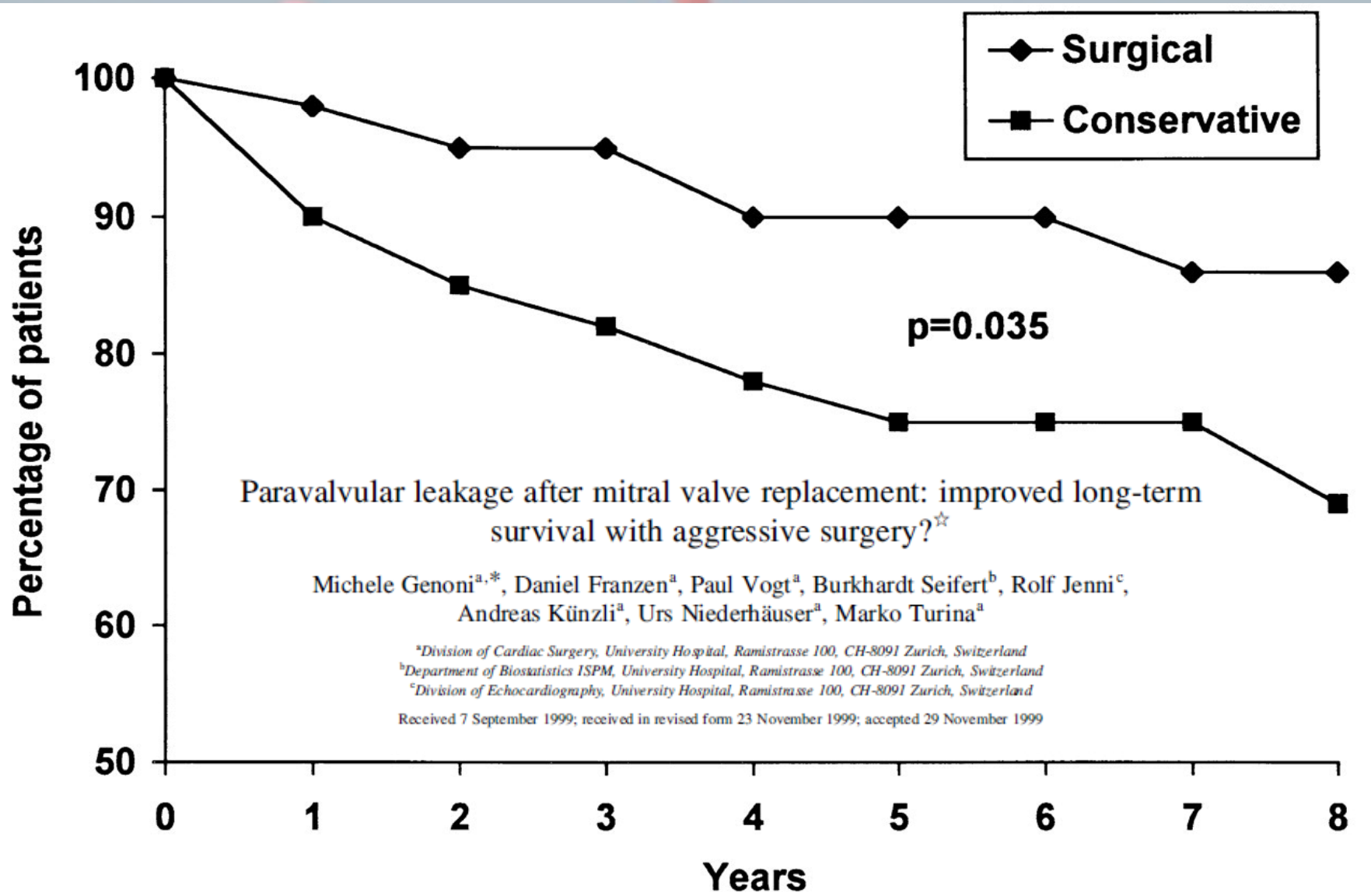
## ❑ Sostituzione della protesi

- Se la riparazione completa del leak non è possibile



QUANDO?!



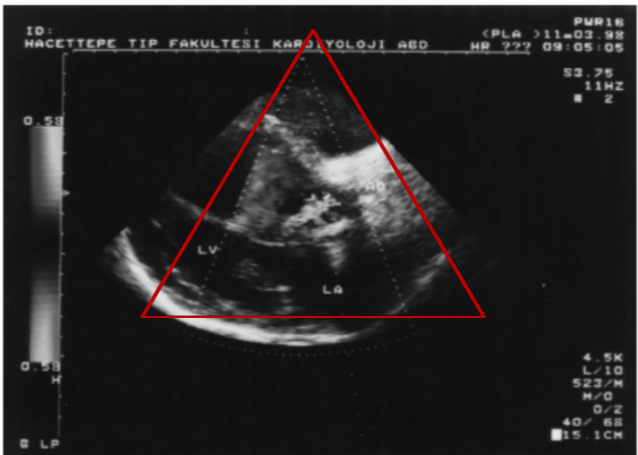




# E PER L'AORTA (1)?

Possibilità intraoperatorie:

- **Punti transmurali** (attraverso l'aorta ascendente **in caso di localizzazione del difetto sulla cusvide non coronarica**),
- **Applicazione di patch** sull'area del leak,
- **Raramente posizionamento di un singolo punto ad U evertente su pledget**;
- **Homograft**, in caso di difficoltosa realizzazione delle suture in presenza di tessuti friabile o infetto .



An alternative repair technique for aortic periprosthetic leakage

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Received 28 September 1998; received in revised form 23 November 1998; accepted 1 December 1998

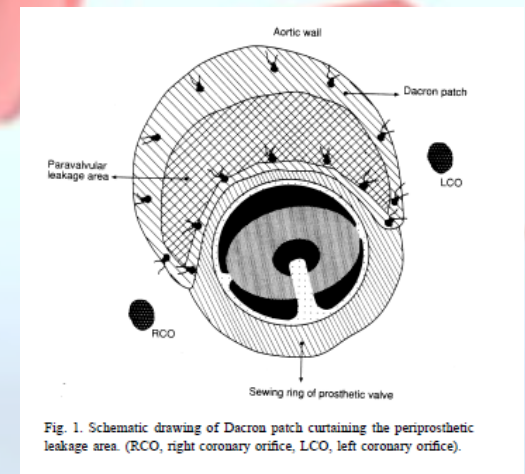
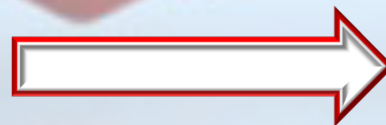
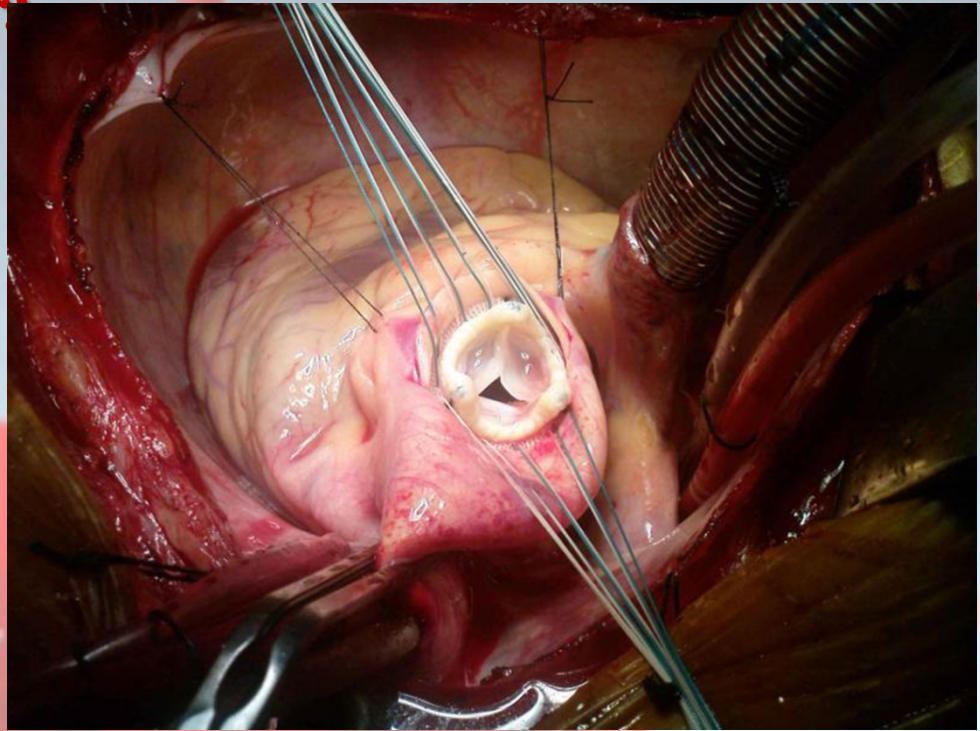
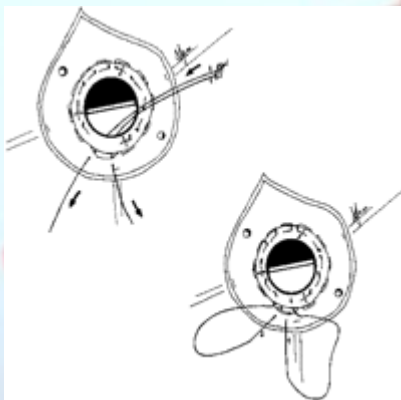
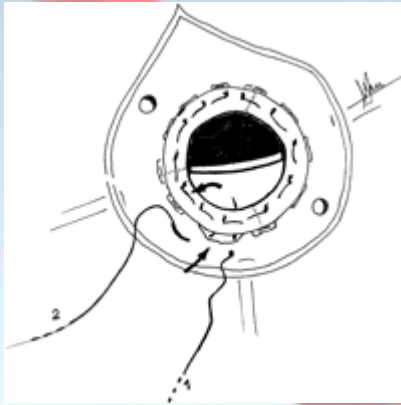


Fig. 1. Schematic drawing of Dacron patch curtailment for the periprosthetic leakage area. (RCO, right coronary orifice, LCO, left coronary orifice).

## Riparazione con Patch



## Nuove tecniche

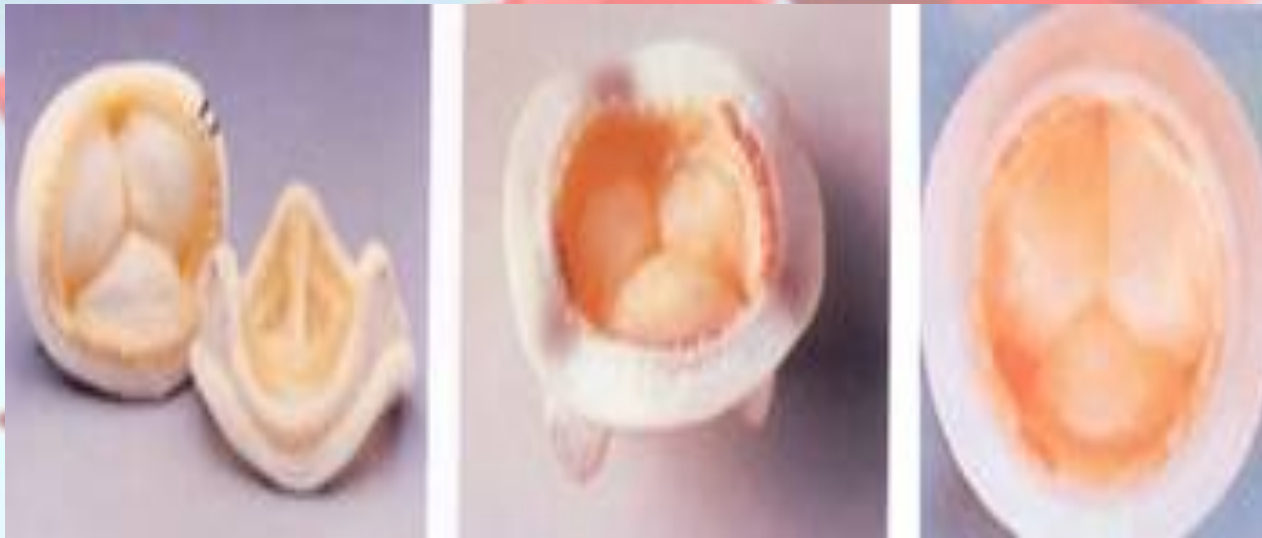


La tecnica richiede **punti intrecciati 2-0 su doppio ago**. Ogni ago è passato **attraverso l'annulus aortico dall'alto verso il basso**, poi **in direzione del ventricolo** e quindi nuovamente e delicatamente attraverso la protesi (Fig. 1). Dopo aver passato il **primo** ed il **secondo punto di sutura**, entrambi vengono **fissati su pledgets** (Fig. 2). Questo assicura che le suture siano saldamente ancorate al tessuto sottovalvolare. I restanti punti di sutura sono passati attraverso l'anello della protesi valvolare.

Questa tecnica chirurgica non è valida per protesi meccaniche di piccolo diametro ( 17 e 19 mm).

Ma quando è necessario procedere alla sostituzione della protesi?

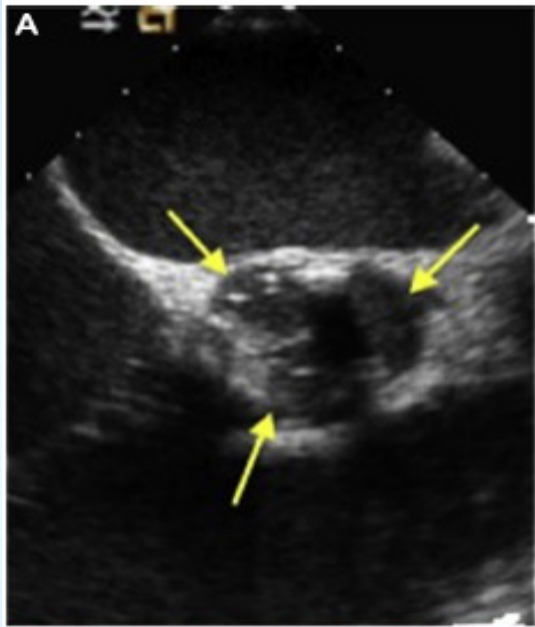
SU PROTESI BIOLOGICA!!



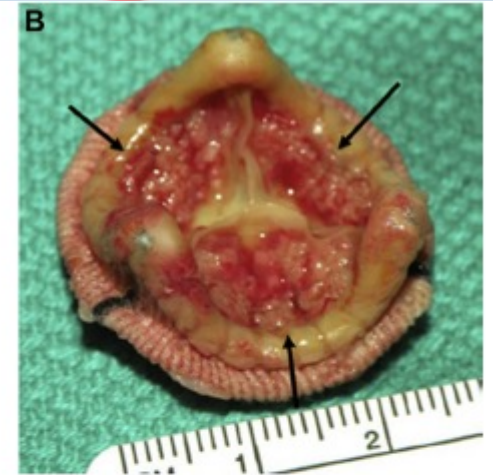
# POSSIBILI INDICAZIONI ALLA RIMOZIONE DELLA PROTESI:

A. Leak associato a trombosi della protesi

## EARLY THROMBOSIS OF BIOPROSTHETIC VALVES

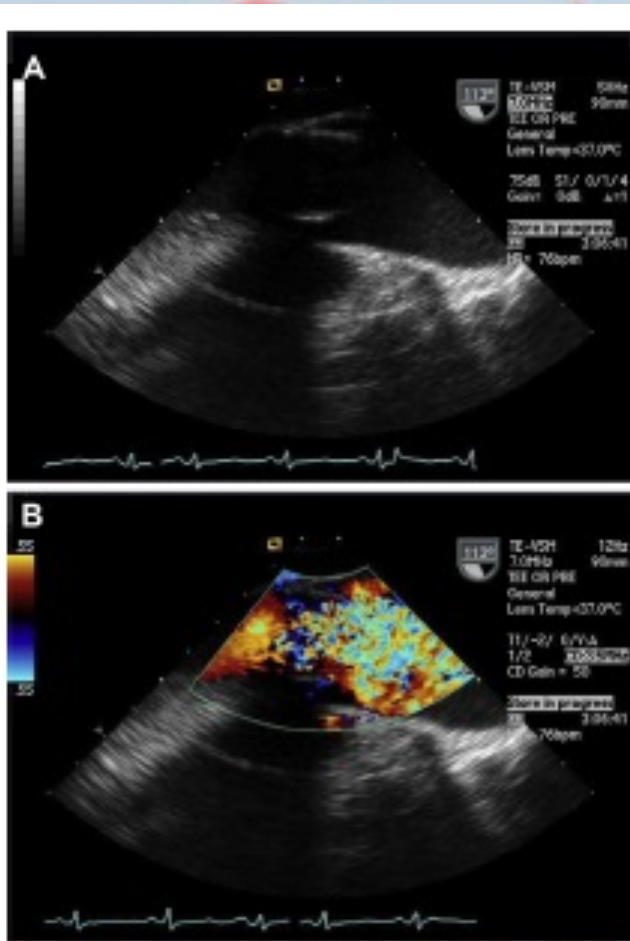


**Figure 2** Transesophageal echocardiographic short-axis view with zoom of the aortic valve (**A**) showing echodensities on non-flow surface of the valve (yellow arrows), confirmed as thrombi on the explanted valve (**B**, black arrows). The flow side of the valve was unremarkable (**C**). Culture of the valve grew *P acnes*, illustrating that a thrombosed valve may also be infected.

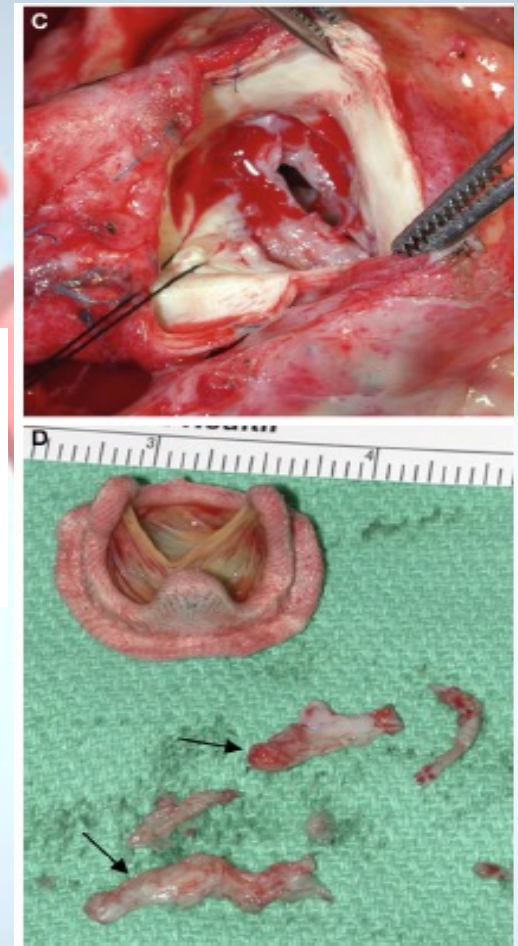


B. Leak associato a panno endocarditico sulla protesi

## EARLY BIOPROSTHETIC VALVE FAILURE RELATED TO PANNUS



**Figure 4** Transesophageal echocardiographic long-axis view with zoom of the aortic valve showing a dilated ascending aorta but no obvious leaflet abnormalities (A). Significant color flow acceleration across the bioprosthetic aortic valve is seen (B). After aortotomy and removal of the bioprosthesis, extensive



## C. Leak dovuto a deterioramento strutturale della protesi

### EARLY FAILURE FROM SVD

Il deterioramento protesico può essere dovuto a:

1) Calcificazioni o fissurazioni

### VALVOLE BIOLOGICHE

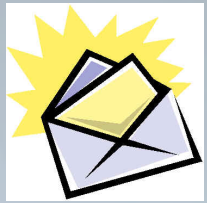
2) Rigurgiti singoli o multipli, centrali o paravalvolari

**Table 1** Clinical features, echocardiographic findings, and management considerations for early bioprosthetic valve failure due to thrombosis, pannus, and SVD

	Thrombosis	Pannus	SVD	
			Calcification	Primary perforation
Possible risk factors	<ol style="list-style-type: none"> <li>1. Very early before sewing ring has endothelialized</li> <li>2. Lack of anticoagulation</li> <li>3. History of atrial fibrillation</li> <li>4. History of thromboembolic events</li> </ol>	<ol style="list-style-type: none"> <li>1. Younger age (? immune response)</li> <li>2. Concomitant PPM</li> </ol>	<ol style="list-style-type: none"> <li>1. Younger age (? immune response and/or hemodynamic stress on valve)</li> <li>2. Mitral as opposed to aortic position</li> <li>3. Diabetes mellitus</li> <li>4. Renal dysfunction</li> <li>5. Abnormal calcium-phosphate metabolism</li> <li>6. Concomitant PPM</li> </ol>	None
Potential echocardiographic findings	<ol style="list-style-type: none"> <li>1. Stenotic valve with echodensities on nonflow surface of valve (flow surface is usually normal)</li> <li>2. Stenotic valve with a large mass obstructing flow</li> </ol>	<ol style="list-style-type: none"> <li>1. Stenotic valve with normal-appearing leaflets; visualization of subvalvular pannus may be difficult because of shadowing from bioprosthesis</li> <li>2. Regurgitation from restriction of leaflet(s), difficult to visualize echodensities or leaflet thickening</li> <li>3. Echodensities may be more apparent with a large amount of pannus or if there is an admixture of pannus and thrombus</li> </ol>	<ol style="list-style-type: none"> <li>1. Stenotic valve with bright echodensities on leaflets or obstruction from extrinsic calcification.</li> <li>2. Regurgitation from a leaflet tear</li> </ol>	<ol style="list-style-type: none"> <li>1. Eccentric regurgitation without echodensities on leaflets</li> </ol>
Management considerations	<ol style="list-style-type: none"> <li>1. Infective endocarditis can coexist</li> <li>2. Anticoagulation</li> <li>3. Consider aortic allograft</li> </ol>	<ol style="list-style-type: none"> <li>1. Consider mechanical prosthesis, especially in a younger patient</li> </ol>	<ol style="list-style-type: none"> <li>1. Consider mechanical prosthesis, especially in a younger patient</li> </ol>	<ol style="list-style-type: none"> <li>1. Must exclude endocarditis</li> </ol>



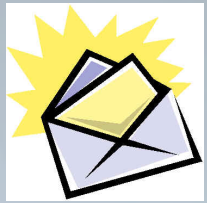
# CONCLUSIONI



## Take home messages

- Riconoscimento precoce del leak.
- Molti sono i leaks rilevati al TEE intraop: distinguere i minori da quelli importanti!
- REINTERVENTO CHIRURGICO MANDATORIO SE:
  - Endocardite
  - Ampi distacchi/leaks
  - In presenza di bioprotesi con segni di degenerazione
- Valutazione accurata dei rischi e benefici del trattamento chirurgico o percutaneo





# CONCLUSIONI

## Take home messages

- La direzione da prendere: scelta percutanea!
- Creazione di centri ad elevata esperienza (> 50 casi)
- ESPERIENZA Monzino (TAVI-Mitraclip etc etc)
- Lavoro in team:
- Bioingegneri/cardiologi:  
ecocardiografisti/cardiocirurghi/emodinamisti/anestesisti
- Supporto delle industrie biomedicali



**GRAZIE  
PER  
L'ATTENZIONE!**