Thrombosis of prosthetic heart valves

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Case 1

► V.B a 54 year old woman, was hospitalized in our service of cardiac surgery.

► **Diagnosis**: Rheumatic Valvular Heart Disease. Severe mitral stenosis. Moderate mitral regurgitation. CHF - NYHA III functional class. Sinus rhythm.

► **Surgical intervention** was performed: Mitral valve replacement with mechanical prosthetic valve *SJM Nr 27*. 
Postoperative period


- **TTE examination**: Maximal and mean prosthetic pressure gradients 8 mmHg and 4 mmHg respectively.

- Day three - Complicated with **A.Fib** and transient cerebral ischemic attack.

- Anticoagulation level was **subtherapeutic**: INR 1.9.
Postoperative period

Day four: *Sinus rhythm* was spontaneously reverted. No dyspnea, stable hemodynamics, prosthetic sound present. *Normal neurological examination*

**TEE examination was performed**

TEE revealed a homogeneous, soft mass, not pedunculated, located at valve strut at LAA level. Dimensions: length 2.3 cm, area 2.1 cm². No obstruction, no increase in mean prosthetic gradient (4 mm Hg). No tricuspid regurgitation.
Non obstructive prosthetic thrombosis

**Therapeutic decision**

According to ESC guidelines (2007) on the management of valvular heart disease *surgery* is recommended for large ( > 10 mm) non-obstructive prosthetic thrombosis complicated by embolism (Class II a, level of evidence C) and *medical therapy* in cases of small thrombosis (< 10 mm)
Therapeutic decision

Considering

► Surgical risk of reintervention
   (early postoperative period)
► Sub therapeutic anticoagulation level (INR 1.9)
► Thrombus characteristics - fresh thrombus
► Spontaneous reversion of sinus rhythm without any further embolic complication

we thought that would be mindful to switch to medical treatment: HEPARIN + Aspirin
Therapeutic result

► After one week of medical treatment (Heparin I/v + Aspirin 100mg/d) another TEE was performed.

► The response to heparin treatment was considered as **thrombolitic success** (based on reduction about 75% in thrombus area) and **clinical success** (no minor or major complications occurred, stable clinical status)
TEE 1

Area = 2.29 cm²
Circ = 6.46 cm
**Therapeutic result**

- Heparin treatment was continued for another week and Cumadin treatment was initiated (Cumadin + Aspirin 100mg). INR level of 3.5 was achieved.
- After two weeks another TEE examination was performed. Thrombus totally disappeared.
Therapeutic result-follow up

9 mths after dismissal, follow up resulted in a very good clinical condition – NYHA class I and normal prosthetic function in echocardiographic examination.
Case 2

► F.B a 42 years old woman was hospitalized in our service with the diagnosis: Suspected prosthesis valve thrombosis. Threatening inferior limb ischemia.

**History:**

► Mitral valve replacement with mechanical monoleaflet (Medtronic) prosthesis 16 years ago.

► Two years ago- transient cerebral ischemic attack, peripheral embolic events with subsequent bilateral lower limb ischemia. ABI dexter and sinister 0.6 and 0.7 respectively

► Not regular follow up. Poor pt compliance
Case 2

► Before 4 months she was diagnosed for large obstructive prosthetic valve thrombus, NYHA functional class III symptoms, and was operated on emergency (large thrombus + pannus was found).

► Sub therapeutic anticoagulation level in admission.
Case 2

This time clinical and laboratory examination revealed:

- Again *subtherapeutic anticoagulation* in admission.
- **Absence of bilateral femoral and popliteal pulses.**
- **No dyspnea at rest, no orthopnea, no tachipnea.** Prosthetic valve sound present. No heart murmurs. Normal breath sounds. Normal **BP. Rhythmic heart sounds**
- Paroxystic A.Fib
Case 2

- **Angio CT of aorta, iliac and lower limb arteries:** Total aortic (at bifurcation level) and iliac (origin) occlusion

- **TTE examination:**
  
  Increase in prosthetic pressure gradients (**mean gradient 14 mm Hg**). Suspected thrombotic mass. No tricuspid regurgitation.

- **TEE examination:**
  
  **PVT - soft mobile obstructive thrombi.**
  
  Considering thrombotic burden and motility, and the previous peripheral embolism cardiac surgery was indicated (class IIa recommendation. ACC/ AHA guidelines 2006)
Timing of cardiac surgery

**Acute threatening lower limb ischemia urged the need of emergent vascular intervention.**

We had to evaluate the risks of cardiac surgery in such a complex situation: critical inferior limb ischemia, re-operation (for the third time, last intervention 4 mths ago), absence of cardiac symptoms at rest.

After informing the pts of her actual clinical status and risks the decision for vascular surgery prior to cardiac surgery was made.
Therapeutic decision

- **Vascular surgery** - Aortic and iliac artery thrombectomy - *revealed fresh and organized thrombi* at aortic bifurcation level and at both iliac arteries. Reversion of femoral pulses and of the previous ABI (0.5/0.7)

- Meanwhile the pt was under treatment with *intravenous Heparin*.

Stable cardiac situation. *Cordaron* to maintain stable sinus rhythm
Therapeutic decision

- **TTE and TEE examination** was performed to reevaluate prosthetic status before taking the next step - *cardiac surgery*.

**Examination results:**
- Diminished thrombus size, decrease in prosthetic pressure gradient (8 mm Hg).
TEE II

VTI = 58.3 cm
Max Vel = 188 cm/s
Mean Vel = 137 cm/s
Max PG = 14.2 mmHg
Mean PG = 7.90 mmHg

Patient Temp: 37.0°C
TEE Temp: 38.1°C
Therapeutic decision

Was cardiac surgery still recommendable?

- Small clot burden.
- NYHA class I-II symptoms. Stable sinus rhythm
- Proven partial hemodynamic success of heparin treatment without clinical complications.

But highly mobile thrombotic mass with an evident risk of embolisation.
Therapeutic decision

We decided to continue treatment with I/V **Heparin** and **Aspirin 100mg** (Recommendation class IIb, ACC/AHA guidelines 2006) for two weeks followed by Cumadine + Aspirine aiming to achieve INR levels near 3.5!
Therapeutic result-follow up

► **TEE III**: Normal prosthetic function. Total thrombus lysis.

► Hemodynamic and clinical success:
  NYHA I functional class, no major or minor complications.
Prosthetic valve thrombosis (PVT) is a rare but serious complication, most often encountered with mechanical prosthesis.

Significant mortality and morbidity warrants rapid diagnostic evaluation.

Variability in clinical presentation makes the diagnosis challenging.

The main diagnostic procedures include: echocardiography - transsthoracic and transoesophageal; cinefluoroscopy
Discussion

► The incidence of **obstructive PVT** for mechanical valves varies between 0.3-1.3% patient years.

► **Non-obstructive** PVT is a relatively frequent finding in the **postoperative period** - reported incidence 10% (in earlier studies up to 12.5-15%)

► PVT incidence in the first postoperative year is 24%, 2-4 years 15% with a subsequent decrease thereafter.

► Thrombembolic complications occur at a rate of 0.7-6% patient years.
Our experience

During the time period of 2001-2007, 480 mitral valve replacements with prosthetic valve were performed in our service: 407 bileaflet (SJM), 67 monoleaflet (35 Sorin, 32 Carbomedix) and 6 bioproshtesis.

9 emergent re-operations because PVT (0.01%).

3 cases with bileaflet PVT (SJM), 6 cases with monoleaflet PVT (4 Sorin, 2 Medtronic). In six cases thrombus and pannus was found. In-hospital mortality of PVT re-operations was 0. In our experience subtherapeutic anticoagulation is found to be the most powerful predictor of PVT and thrombembolic complications.
Our experience

► Heparin was proven successful in three other cases of Left atrial thrombosis in our service:

2 cases with LAA thrombi
1 with interatrial septum aneurysm thrombi
Diagnosis-echocardiography

Transthoracic echocardiography

► Transvalvular flow gradient
► Inspection of the prosthesis

( Class I recommendation, level of evidence B; ACC/AHA valve disease guidelines 2006)
Diagnosis-echocardiography

Transoesophageal echocardiography

TEE is currently the test of choice for

- diagnosis
- guiding the therapeutic strategy: thrombus burden
- assessing the treatment efficacy

(Class I recommendation, level of evidence B; ACC/AHA valve disease guidelines 2006)
Treatment

Although surgical treatment is usually preferred in cases of obstructive PVT, optimal treatment remains controversial. Different therapeutic modalities are available:

- Surgery
- Heparin treatment
- Fibrinolysis
Treatment

Choice between *surgery* and *medical treatment* is influenced by:

- presence of valvular obstruction
- valve location (left-or right sided)
- thrombus size
- clinical status
First successful thrombolytic treatment of a thrombosed Starr-Edwards prosthesis in tricuspid position was reported by Luluaga et al in 1971.

Since than thrombolytic therapy has emerged as an alternative to re-operation.

Case reports and series vary widely in the mortality and morbidity rate associated with thrombosis, more than in rate of success.
Treatment

Definition of

**Thrombolytic success**: A reduction >75 % in thrombus largest diameter.

**Hemodynamic success**: 

- **Complete Hemodynamic success**: Return of the transvalvular gradient in normal range.
- **Partial Hemodynamic success**: partial improvement of the transvalvular gradient

**Clinical success**: Hemodynamic success without clinical complications.
Treatment

Pro-TEE registry results identified

► thrombus size > 0.8 cm²

► history of previous stroke

as the major risks factors for complications of lytic treatment

JACC 2004
International Pro-TEE registry recommendations
Left sided obstructive thrombi

Thrombus size

Thrombus $< 0.8\text{cm}^2$
- Thrombolysis

Thrombus $>0.8\text{cm}^2$
- Surgical vs lytic risk
  - yes
  - lower surgical risk
  - no
  - thrombolysis
  - surgery
Pro-TEE registry results

Relationship of thrombus area to overall complication and death rate. *p=.003 **p <.0001 øp=.016
Pro-TEE registry results

Incidence of complication and death rate according to the presence and absence of the two risk factors (RF) **thrombus area** and **previous stroke**
Treatment

Non obstructive left-sided PVT

- Large ( > 5 mm) thrombi
  - surgery in case of failure to medical treatment (heparin), particularly in the presence of mobile and pedunculated thrombi.

- Small (< 5mm) thrombi - medical treatment:
  - heparin or warfarin plus 100mg aspirin

  *Heparin treatment alone in pts with fresh large mobile thrombi and subtherapeutic anticoagulation has been demonstrated successful in case reports*

  *Heart 2007*
Obstructive thrombi

ACC/AHA valve disease guidelines 2006:
Class :IIa , level of evidence : C

1. Emergency operation is reasonable for the following pts left sided PVT.
   A. Pts with NYHA functional class III-IV symptoms.
   B. Pts with large clot burden

2. Fibrinolitic is reasonable for thrombosed right sided prosthetic valve with NYHA functional class III-IV symptoms or large clot burden
Treatment

► Class II B

1. *Fibrinolitic therapy* as a first-line treatment

In left side PV T for the following pts

A. Pts with NYHA functional class I-II symptoms, and a small clot burden (level of evidence : B)

B. Pts with NYHA class III-IV symptoms and a small clot burden if emergency surgery is of high risk or not available (level of evidence : B)
Treatment

C. Pts with obstructive PVT, NYHA class III-IV and a large clot burden if emergency surgery is high risk or not available (Level of evidence C)

2. Intravenous heparin as an alternative to fibrinolitic therapy for pts in NYHA I-II and a small clot burden
Management of left-sided obstructive prosthetic thrombosis.
Figure 6  Management of left-sided non-obstructive prosthetic thrombosis.
Thank you for your attention