CHIRURGIE CARDIAQUE / CARDIAC SURGERY

MITRAL-TRICUSPID DISEASE: SURGICAL EXPERIENCE IN COTE D'IVOIRE

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Summary

The aim of this study was to report our experience on mitral-tricuspid valve disease treated surgically. **Material and Methods:** 72 patients with mitral-tricuspid valve disease were collected between December 1983 and November 2009. We studied the epidemiological, clinical, paraclinical and therapeutic data. Only patients with mitral disease (mitral regurgitation and mitral stenosis) associated with tricuspid insufficiency (TI) or mitral stenosis associated with tricuspid regurgitation were included. All patients with isolated tricuspid stenosis were excluded from the study.**Results:** Patients' mean age was 19 years old. Sex ratio was 2 women/1 man. 61.1% of patients had a functional class NYHA III or IV. The dominant etiology was acute rheumatic disease in all cases. Mean cardiothoracic ratio (CTR) was 0.67 ± 0.12 with sinus rhythm (44.4%) and atrial fibrillation (56.6%). The bi-dimensional echocardiography was contributory in all patients. At cardiac catheterization with angiocardiography, mean diastolic pressure of the right ventricle was 40.20 ± 20.75 mmHg and mean pulmonary arterial hypertension was 41.15 ± 11,81mmHg.Surgical procedures were replacement (n = 68) or valvuloplasty (n = 4) of the mitral valve associated with tricuspid annuloplasty (TA) or not. 42 De Vega TA and 10 TA Carpentier-Edwards were performed. Then, 20 TI were surgically neglected. Operative mortality was 2.8 % (n = 2). It was mainly due to the neglected TI. 2 deaths were due to a cardiogenic shock secondary a global cardiac failure (n = 2) to (n = 1).12.5 % and 7.14 % of the earliest complications were respectively observed in case of neglected TI and in case of De Vega TA (p = 0.045).Late global morbidity was 27.8 %. These complications happened differently in case of neglected TI or De Vega TA (P = 0.039). Clinical and radiological improvement was observed at least for 4 out of 5 patients treated by De Vega TA during mitral valve replacement. Echo-cardiographic regression of the tricuspid leak was 1 ± 0.75 rank. In the long term monitoring, the risk factor significantly associated with the increase of complications was the neglected TI (RR = 5.77; P = 0.03). At 10 years follow-up, and at late cardiac catheterization tricuspid leaks were small (grade I = 36; 56.3 %), moderated (grade II = 20; 31.3 %), important (grade III = 6; 9.4 %) and very important (grade IV = 2; 3.1 %). **Conclusion:** Our results show that the neglected TI seems to aggravate the evolution of mitral-tricuspid valve disease after surgery. Nevertheless, more important series will be necessary to confront that assertion. ***Keywords:*** *Tricuspid regurgitation- mitral valve Surgery.*

Introduction

Mitral-tricuspid disease is a polyvalvulopathy associating either a mitral disease with that of a tricuspid valve, or a mitral disease with a tri - cuspid insufficiency and / or tricuspid stenosis [1]; it often concerns children and young adults[1,2]. Global heart failure which is the most frequent mode of its clinical discovery. Its diagnosis is mainly clinical and its prognosis after surgery is often related to pejorative parameters that are not yet sufficiently elucidated in literature;That is the reason why this study was carried out, the purpose of which is to identify the factors of poor prognosis of mitral-tricuspid surgery in our african context.

Material and methods

Between December 1983 and November 2009, 72 patients with mitral-tricuspid disease were collected.Epidemiological characteristics,clinical electrocardiographic, echocardiographic,hemodynamic and angiocar diographic data, indications and surgical results were studied.

Quantitative variables were expressed as mean ± Standard Derivation (SD). Comparisons were made using the chi-square and fisher tests for qualitative variables. Kaplan Meier method was used to calculate the probability of post-operative complication. For all these tests, the threshold of significance was $p < 0.05$. All patients with tricuspid stenosis, as well as those with aortic valvulopathy were excluded from the study.

Results:

There were 48 female patients and 24 male patients, a sex ratio of 0.5. Patients' history is shown in Table Ia. Mean age of our patients was 19 years (extremes: 8 and 59 years). Dominant etiology was rheumatic heart fever(table Ia).

Mean time between symptomatology onset and consultation was 5.7 years (extremes: 1 month - 18 years). Patients were in NYHA functional class II (n = 28,38.9%),class III (n = 36, 50%), and NYHA class IV (n = 8; 11.1%). Hepatomegaly (n = 62), hepato-jugular reflux (n = 46), and crackling rales at both lung fields (n = 47) were noted. Patients with heart failure were associated with a systolic murmur of TI associated with a mitral stenosis (n = 4), mitral insufficiency (n = 36), or both mitral insufficiency and stenosis (n=32) (Table Ia).

80.6% of patients had radiological cardiomegaly with an average cardio-thoracic index at 0.67 ± 0.12. The electrocardiogram (Table Ia) showed sinus rhythm (n = 32) and atrial fibrillation (n = 40).

Cardiac Doppler-associated echocardiography showed rheumatic mitral lesions (n = 72), pulmonary arterial hypertension (n = 64); and the degree of preoperative mitral and tricuspid valvular leak are shown in Tables Ib, Ic and Id.

Mitral valve replacement (n = 68) with a mechanical prosthesis (n = 40) or a biological prosthesis (n = 28) were performed under cardiopulmonary bypass,moderate hypothermia at 21ºC and cross aorta clamping.Types of implanted prostheses are shown in Table II.

Mitral repair was done in 4 patients. In the case of functional and organic TI, De Vega TA was performed in 42 patients and Carpentier-Edwards TA in 10 cases. Functional TI was neglected in 20 other patients after a pre-operative inspection of the tricuspid valve and an instantaneous tricuspid valvular continence test with 50cc of saline serum.Hospital duration stay was 8 ± 4.5 days (extremes: 5 – 17 days).

Operative mortality was 2.8% (n = 2),due to low cardiac output . Immediate post-operative morbidity was 12.5% (n = 7) due to: worsening of right heart failure (n = 2), hepatocellular insufficiency (n = 1), pulmonary infection (n = 3), and atrial fibrillation (n = 1) in patients with neglected functional TI. In the case of De Vega TA, 4 patients (7.14%) had immediate post-operative complications: atrial fibrillation (n = 2), low cardiac output syndrome (n = 1), and mediastinitis (n = 1). Immediate post-operative complications were related to neglected TI (Chi-2 = 0.982, $p = 0.045$). At 1 year, in cardiac catheterization, the comparative study of mean hemodynamic values as illustrated in Table III showed a statistically significant improvement of right ventricular end-diastolic pressure, pulmonary arterial pressure, left ventricle ejection fraction and cardiac index. At the angiocardiography, tricuspid leakage was minimal (n = 58, 78.38%), moderate (n = 10, 13.51%), and significant (n = 6; 8.11%).

In late post-operative(<5years),NYHA functional class improved in all patients with tricuspid plasty with regression or even disappearance of TI systolic murmur (n = 52). Out of the 70 patients followed regularly, at 5 years, mortality was 5.7% (n = 4). Death was caused by cardiogenic shock (n = 4). Improvement of the NYHA functional class was observed in the 66 survivors, 72% (n = 42) of whom were De Vega TA.Post-operative morbidity at 5 years was 27.8%. (N = 18). These complications are mentioned in Table I V. Two patients (2.8%) were re-operated. One was re-operated at 4 years for severe MI associated with infective endocarditis on a biological prosthesis and the other at 5 years for a failure of a De Vega TA. At 10 years follow-up, 58 patients had an improvement of NYHA functional class (n = 30, 53.70%), a regression of the radiographic Cardio-Thoracic Index (n = 39, 67.15%) and regression of echocardiographic grade of the functional tricuspid leak averaging 1 ± 0.75. Morbidity was 13.3% for De Vega AT and 41.3% for neglected FTI during mitral valve replacement (p = 0.039). Neglected functional TN was the only risk factor significantly associated with complications (RR = 5.77, (0.99 -45.30), p = 0.03). These complications were atrial fibrillation (n = 4, 6.9%), heart failure (n = 8, 16%); (N = 4; 6.9%) and ischemic stroke on a mechanical prosthesis (n = 2; 3.45%). Survival of patients without thromboembolic event after MVR was 84 ± 7.2% at 10 years (Figure 1). At 15 years follow-up, the rate of deterioration of bio-prostheses was 15.38% (n = 11) as illustrated in Figure 2. Overall survival including deaths without post-operative complications is illustrated in *Figure* 3,4, 5. It varied according to surgical procedures *(Figure 6).*

Table Ia: Mitral-tricuspid diseases: Pre-operative clinical diagnosis

Variables of studies		**Number (n)**	**Percentage (%)**
History	History of RF*	34	47.2
	At least 2 episodes of right and/or left cardiac failure	17	23.6
Mitral lesions	Mitral disease	32	44.4
	Mitral stenosis	4	5.6
	Mitral insufficiency	36	50
Tricuspid insufficiency	Minimal	22	2.8
	Moderate	44	61.1
	Severe	26	36.1
Electrocardiographic parameters	Atrial Fibrillation	40	55.6

RF : Rheumatic Fever*

Table Ib:
Tricuspid insufficiencies: Preoperative echocardiographic characteristics and Doppler

Variables			***Number (n)***	**Percentage (%)**
Tricuspid insufficiency	Minimal	(grade I)	*2*	2.8
	Moderate	(grade II)	*44*	61.1
	Severe	(grade III)	*26*	36.1
	massive	(grade IV)	*0*	0

Table Ic: Hemodynamic and Angiographic preoperative characteristics

Variables	Number (n)	Mean Percentage (%)	
RAP (mmHg)	-	-	16.13 ± 4.31
RVTDP (mmHg)	-	-	40.20 ± 20.75
PAP (mmHg)	-	-	41.15 ± 11.81
WPCP(mmHg)	-	-	21.36 ± 8.81
LVTDP (mmHg)	-	-	31.65 ± 3.85
CI (L.min.m^{-2})	-	-	1.90 ± 0.47
LVEF (%)	-	-	60.45 ± 12
Minimal TI	12	16,2	-
Moderate TI	46	62,2	-
Severe TI	14	21-6	-

RAP: Right Atrial Pressure
RVTDP: Right ventricle endiastolic pressure
PAP: Pulmonary arterial pressure
LVEF: Left Ventricle Ejection Fraction
WPCP: Wedge pulmonary capillary pressure
LVTDP: Left ventricle enddiastolic pressure
CI: Cardiac index
TI : Tricuspid insufficiency

Table Id:
Mitral-tricuspid valvulopathies: Pre-operative echocardiographic ,döppler, and angiocardiographic characteristics

	Variables		Mitral-tricuspid valvulopathy MI (n=32) N	%	MS (n=4) N	%	TI (n=72) N	%
Echocardiography + Doppler	Degree of valve leak	Minimal (grade 1)	0	0	-	-	2	2.8
		Moderate (grade II)	10	S1.S	-	-	44	61.1
		Severe (grade III)	22	68.7	-	-	26	S6.1
	Degree of valve stenosis	Moderate	-	-	2	50	-	-
		Tight	-	-	1	25	-	-
		Very tight	-	-	1	25	-	-
Angiocardiography	Degree of valve leak	Grade II	8	25	-	-	12	17
		Grade III	16	50	-	-	45	62
		Grade IV	8	25	-	-	15	21
	Degree of valve stenosis	Moderate	-	-	0	0	-	-
		Tight	-	-	3	55	-	-
		Very tight	-	-	1	25	-	-

MI: Mitral insufficiency
TI: Tricuspid Insufficiency
MS: Mitral stenosis

***PS**: Mitral diseases (n=36) were excluded from the table*

Table II Type of prostheses implanted in mitral position

Type of prostheses		Number (n)	Percentage (%)
Mechanical prostheses: (n = 40 ; 53%)	Starr-Edwards	34	44
	St Jude	4	6
	Duromedics	2	S
Biological prostheses: (n = 28 ; 47%)	Carpentier-Edwards	24	41
	Hancock II	4	6
TOTAL		**68**	**100**

Table III: Comparison between preoperative *and* post-operative hemodynamic values at 1 year follow-up.

Mean Hemodynamic Variables

	Pre-operative	Post-operative	
RAP (mmHg)	16.13 ± 4.31	14.58 ± 5.43	NS
RVTDP (mmHg)	40.20 ± 20.75	13.07 ± 12.70	S
PAP (mmHg)	41.15 ± 11.81	25.5 ± 7.72	S
BPCP (mmHg)	21.36 ± 8.81	19.13 ± 10.78	NS
LVTDP (mmHg)	31.65 ± 3.85	34.43±2.37	NS
CI (L.min. m^2)	1,90 ± 0,47	2.40 ± 0.50	S
LVEF (%)	60,45 ± 12	68.15 ± 21.50	S

***RAP** : Right Arterial Pressure; **RVTDP**: Right ventricle telediastolic pressure; **PAP** : Pulmonary Arterial Pressure; **WPCP** :* Wedged *Pulmonary Capillary Pressure; **LVEDP**:Left Ventricle End-diastolic Pressure; **CI** : Cardiac Index; **LVEF** : Left Ventricle Ejection Fraction ; **S** : Significant; **NS** : Non-Significant*

Table IV: Post-operative complications at 5 years follow-up

Post-operative complications	Number (n)	Percentage (%)
Low heart output	5	27.8
Chronic respiratory distress	1	1 5.6
Atrial Fibrillation	2	11.1
Coagulation troubles	4	22.2
Pseudo-cirrhosis liver	2	11.1
Insufficiency hepatitis	2	11,1
Supra-ventricle Tachycardia	2	

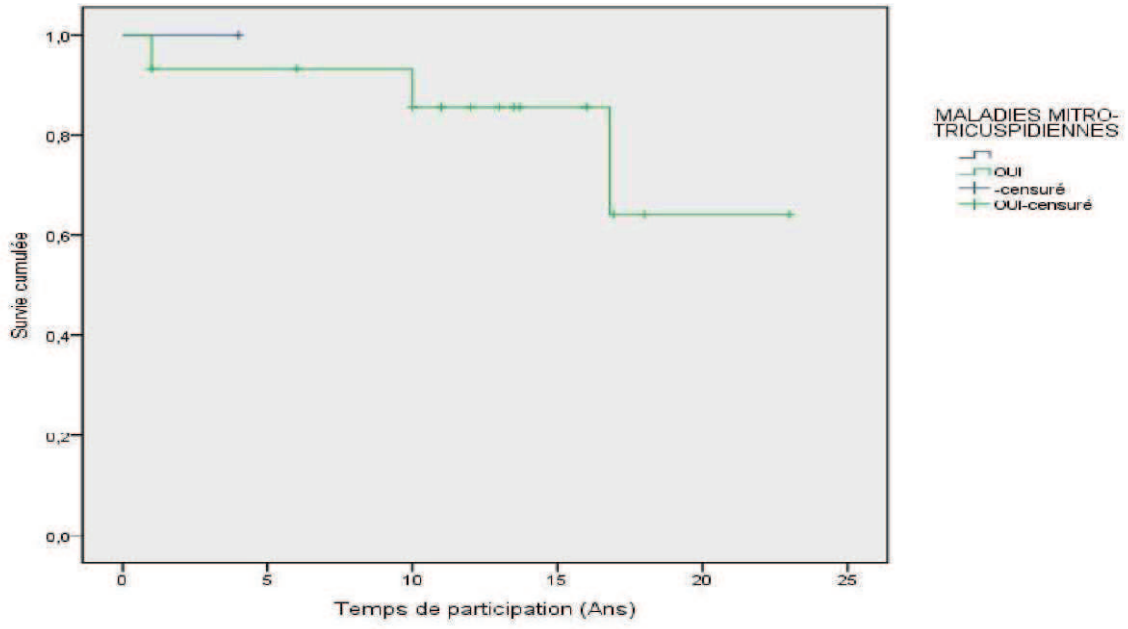

Figure 1: Kaplan Meir curve of patients with mitral bio-prostheses without degeneration.

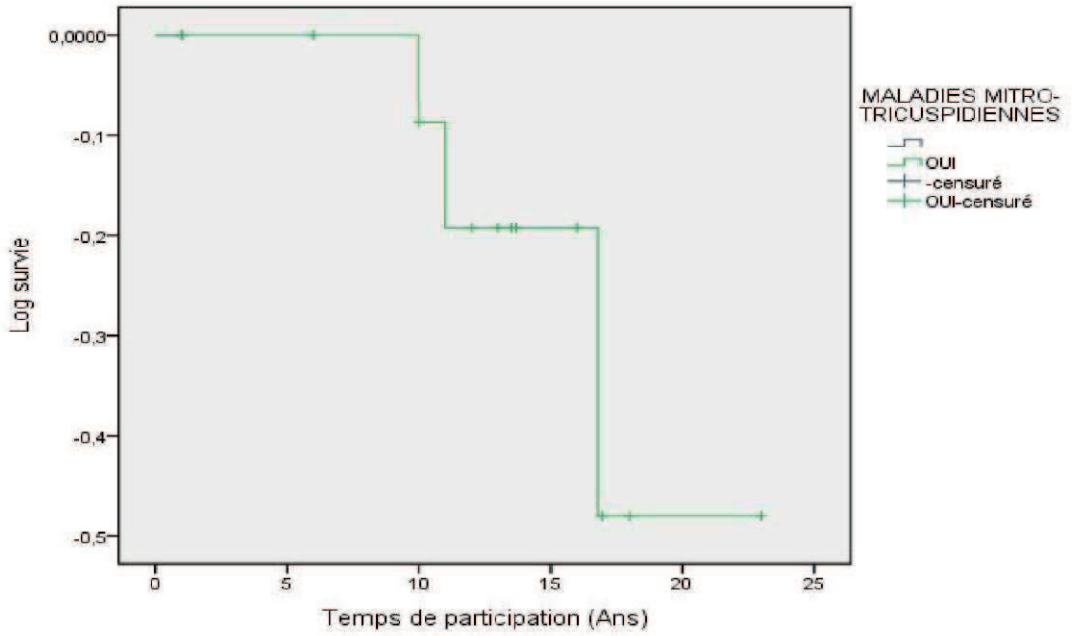

Figure 2: Kaplan Meir curve of patients with mitral bio-prostheses without reoperation .

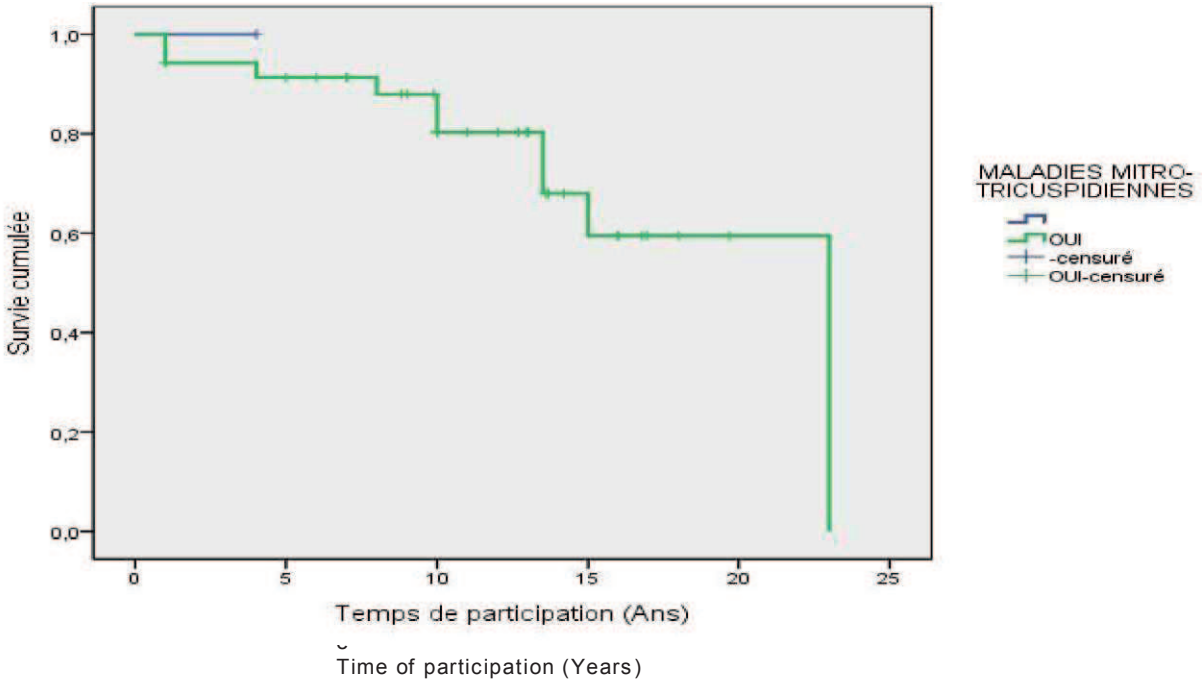

Figure 3: Kaplan Meier global survival curve of patients without post-operative complications

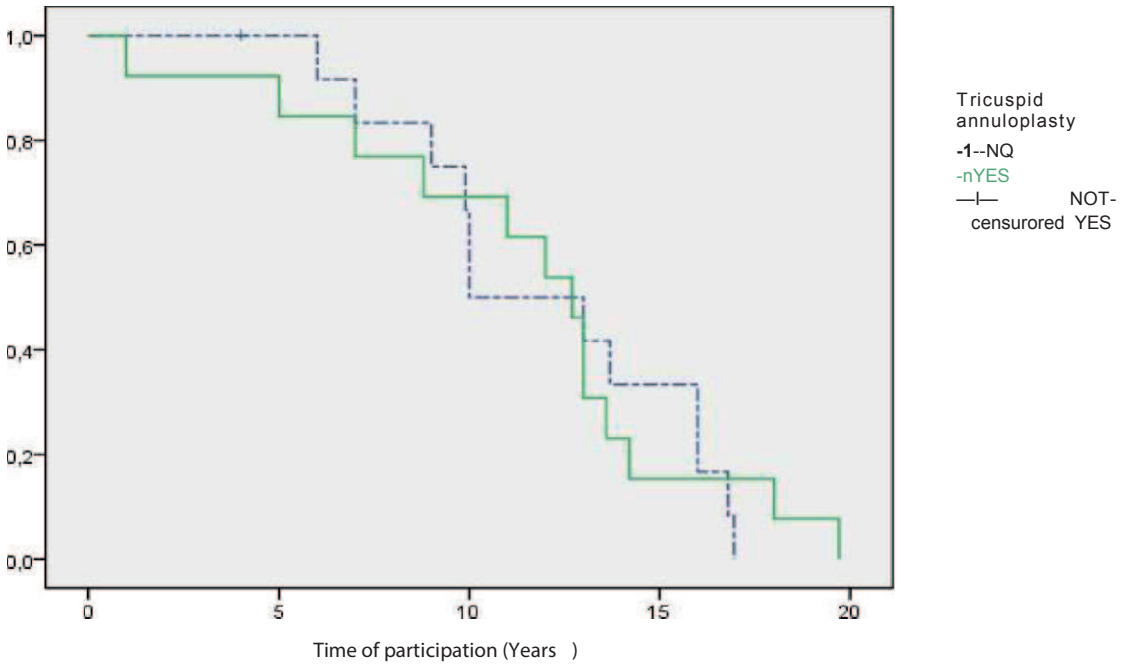

Figure 4: Kaplan Meier global survival curve of patients with mitral prostheses without postoperative complications after De Vega or Carpentier-Edwards annuloplasty *versus neglected functional tricuspid insufficiency* (FTI).

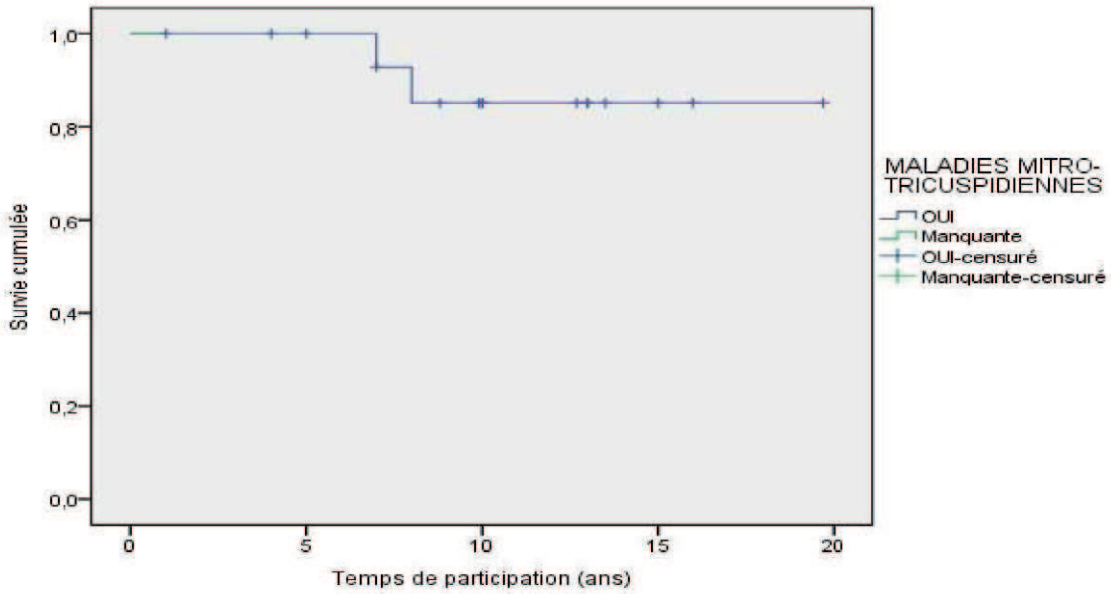

Figure 5: Kaplan Meier survival curve of patients with mechanical prostheses in mitral position without thromboembolic complications

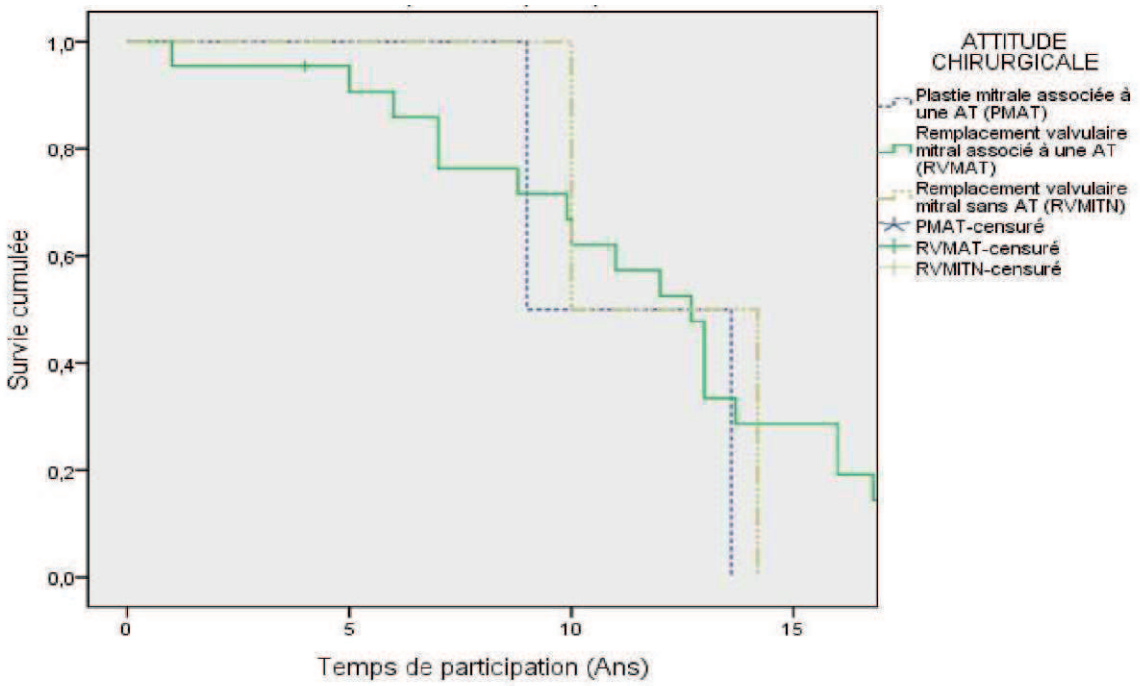

Figure 6 : Kaplan Meier global curve of patients without postoperative complications according to surgical procedures

Discussion:

Surgical treatment of mitral-tricuspid diseases shows some peculiarities in our practice regarding our study.Echocardiography was the principal investigation for diagnosis and surgical treatment in different studies[4]. For Califiore AM et al[4], a comprehensive diagnostic strategy for functional TIs diagnostic by a frequent echocardiography could reduce functional TIs prevalence during mitral surgery, and according to Tager R. et al.[5] would improve long-term surgical outcomes of rheumatic mitral-tricuspid diseases. As noted in our study, several authors reported a clinical improvement or even a regression of functional TIs signs in at least 4 years after surgery[5 6,7,8,9]. In the medium term,as others[10] we noted a significant hemodynamic values improvement after performing TA during a mitral valve replacement. Complications may occur after any tricuspid annuloplasty[4,10,11,12]; the same observation has been reflected by us in our work with an. higher morbidity than results reported in the literature[6,8,11]; However, it is difficult to make any comparaison because our patients epidemiological and clinical characteristics cannot be superimposed on those of the other series of the literature. Surgical treatment of TI is rarely isolated[11,13,14]. The choice of the type of tricuspid annuloplasty is debatable[15] and depends not only on left cardiac valve surgery procedure but also on left intracardiac hemodynamic condition[14]. Regardless of the wide spectrum of mitral-tricuspid lesions or of valvular symptomatology heterogeneity, replacement or repair of the tricuspid valve does not affect immediate post-operative mortality according to Barratt-Boyes[16] and other authors who observed significant improvement in NYHA functional class and pre-operative clinical data in their series[6,9,12,14,16,17]. Those authors[9,12,14,16] did not hesitate to neglect surgically functional echocardiography grade IITI. In doing so, it was found that re-operation rate for neglected functional TIs decreased during the follow-up at 5 years[7,8,18,19,20].

Several authors evaluated their experience with TA different techniques[15,19,21,22]: According to them, as found in our study, tricuspid annuloplasty leads to an effective suppression of pre-operative functional TIs and a clear improvement of patients' functional status .

Conclusion: Operative indication should be systematically discussed before any mitral-tricuspid valvulopathy associated with right heart failure symptoms.In case of right ventricular clinical failure any echocardiographic grade I / II and II functional tricuspid insufficiency coexisting with mitral disease should be considered during mitral valv surgery to prevent risks of complications in the post-operative medium and long term follow-up.

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