Mid-term Follow-up of Patients Following Tricuspid Valve Replacement

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YAPAY TRİKÜSPİD KAPAKLI HASTALARIN ORTA VADELİ TAKİP SONUÇLARI

Ocak 1980, Ocak 1996 tarihleri arasında 620 mültivalvüler kalp hastasına çeşitli tiplerde triküspid kapak girişimi uygulandı (De Vega annüloplasti: 483, Kay annüloplasti: 8, Duran ringi implantasyonu: 15, Puig-Massana ringi: 18). Bunların 96'sına (% 15.5) 100 prostetik triküspid kapağı (69 mekanik, 31 biyolojik) takıldı. Bu olgulara aynı zamanda 65 mitral, 21 aort kapağı implante edildi. Kırk üç hasta daha önce kapalı mitral komissürotomi (12), mitral kapak replasmanı (18), mitral ve aort replasmanı (6), ventriküler septal defekt tamiri (2), atriyal septal defekt tamiri (2), Fallot tetralojisi tam düzeltme operasyonu (1) ve Ebstein anomalisi onarımı (2) gibi cerrahi girişimler geçirmişlerdi. Ortalama yaş 35±11 (14-56) yıldı ve olguların % 20'si erkekti. Tüm hastalarda önce bir annüloplastik teknik denendi. Fakat yeterli sonuç alınmayan olgularda triküspid kapak replasmanı yapıldı. Konjenital olgular dışındaki hastalarda triküspid girişimleri kardiopulmoner bypass (CPB) altında çalışan kalpte gerçekleştirildi. Preoperatif pulmoner arter basıncı (PAP): 54 ± 21, pulmoner kapiller basınç (PCWP): 23 ± 8, santral venöz basınç (CVP): 16 ± 5 mmHg olarak ölçüldü. Olguların % 95'i atriyal fibrilasyondaydı. Erken mortalite % 26 oldu. Olguların % 84'ü 2 ay ile 121 ay arasında (ortalama 45 ± 22 ay) izlendi. Dört olgu triküspid kapak disfonksiyonu (tromboz: 2, biyolojik kapak dejenerasyonu: 1, paravalvüler kaçak: 1) nedeniyle tekrar ameliyat edildi. İzleme döneminde 6 olgu (% 8.5) kaybedildi. Oniki, 36 ve 48 aylık yaşama oranları sırasıyla % 66, % 52 ve % 30 olarak hesaplandı. Medyan yaşam süresi 42 ay oldu. Hayatta kalanların NYHA fonksiyonel kapasiteleri % 67 olguda klas I ve II düzeyindeydi. Sonuç olarak, tamiri başarılı olmayan triküspid kapakların prostetik kapaklarla değiştirilmesi, yüksek erken mortaliteye rağmen orta vadede kabul edilebilir bir yaşam süresi sağlamaktadır.

Anahtar kelimeler: *Triküspid kapak, annüloplasti, mekanik kapak, biyoprotez, replasman.*

Tricuspid valve replacement (TVR) is one of the most challenging questions in cardiac surgery, and there is not recommended, it is inevitable in some cases. On the other hand, controversy arises with respect to appropriate prosthesis for tricuspid valve replacement. This study reviewed 96 cases in which 100 tricuspid valve replacements were carried out in our Center between January 1980 and January 1996. We evaluated our results and compared with those in the available literature.

MATERIALS and METHODS

Between January 1980 and January 1996, 620 patients with valvular heart disease underwent several types of tricuspid valve procedures in Siyami Ersek Cardiovascular Center. Several types of annuloplastic procedures were performed in 524 patients, including De Vega semi-circular annuloplasty (n=483, 92%), implantation of Puig-Massana ring (n=18, 3.5%) and Duran ring (n=15, 3%), and Kay annuloplasty (n=8, 1.5%). Among these, 96 patients received 100 prosthetic tricuspid valves, accounting for 15.5% of all the tricuspid valve procedures.

The mean age of patients who received a prosthetic tricuspid valve was 35±11 years with a range of 14 to 56 years. Eight percent of the cases were females.

Hospital charts of all patients under study were reviewed. Their last functional status as of January 1996 was obtained by direct contact with the patients or the referring physician; at least one echocardiographic evaluation was accomplished in the follow-up period.

The leading cause of tricuspid valve endocarditis required replacement of the tricuspid valve.

Preoperatively, the predominant valvular lesion was tricuspid insufficiency (82%). Tricuspid stenosis and tricuspid stenosis plus insufficiency were present in six percent and eight percent of cases, respectively. Four cases were presented with Ebstein's anomaly.

Forty-three cases (45%) had previous heart surgery including closed mitral valvotomy (n=12), repair of ventricular septal defect (n=2) or atrial septal defect (n=2), total correction of Fallot Tetralogy (n=1), repair of Ebstein's anomaly (n=2), mitral valve replacement (MVR) (n=17), mitral and tricuspid valve replacement (MVR+TVR) (n=1), mitral and aortic valve replacement (MVR+AVR) (n=5), mitral and aortic and tricuspid valve replacement (MVR+AVR+TVR) (n=1), and mitral reconstruction and AVr (n=1).

Mean preoperative pulmonary artery pressure was 54±21 mmHg, ranging from 26 to 108 mmHg. Pulmonary capillary wedge pressure was between 10 and 38 mmHg (mean 23±8 mmHg), and central venous pressure 16±5 mmhg (range 11-26 mmHg). Ninety-five percent of patients had atrial fibrillation. Fifty-two percent of patients were in NYHA class III and 32% in class IV; there were no patients in class I.

Operations were performed under standard cardiopulmonary bypass, mild systemic hypothermia (28°-32°C), cold (4°C) intermittent antegrade crystalloid cardioplagia, and topical myocardial cooling with iced saline slush. In all cases, an annuloplastic technique was first attempted. Tricuspid procedures were accomplished under cardiopulmonary bypass with beating heart without aortic clamping when this was possible. Prosthetic valves were implanted using interrupted horizontal mattress sutures with pledgets.

A total of 100 prosthetic tricuspid valves were implanted to 96 patients. Sixty-nine mechanical prostheses included 21 carboMedics, 20 Medtronic, 9 St. Jude, 8 Sorin Monoleaflet, 8 Björk-Shiley, 2 Hall-Kaster, 1 Omniscience.

Thirty-one bioprostheses were also used (Biocor porcine heart valve: 18, Wessex Medical porcine bioprosthesis: 7, Hancock: 3, Carpentier-Edwards: 2 and one Ionescu-Shiley bovine pericardial xenograft).

Sixty-five mitral, twenty-one aortic and mitral replacements, and one aortic concomitant valve replacement were also made. Mitral valve reconstruction was performed in the patient with aortic and tricuspid valve replacement. Four cases underwent an operation for the correction of Ebstein's anomaly. A fourteen-year-old boy with tetralogy of Fallot received a prosthetic tricuspid valve three months after the total correction because of the native tricuspid valve endocarditis. On the other hand, TVR was performed in four cases who were primarily operated on for closure of the secundum type atrial septal defect (n=2) and ventricular septal defect (n=2).

Surgical exploration of the tricuspid valve revealed that annular dilatation was the predominant lesion (81%); commissural fusion was present in 14%. Displacement of the septal and posterior leaflets confirmed Ebstein's anomaly in 49 and leaflet degeneration and perforation were seen in the native tricuspid valve endocarditis (1%).

RESULTS

Early or hospital mortality was 26 % (25 cases). Twelve cases could not be weaned from cardiopulmonary bypass. The other causes of early deaths were right heart failure (n=5), hemorrhage (n=3), arrhythmia (n=3), pulmonary embolism (n=1) and mediastinitis (n = 1).

Eleven of these early deaths were previously operated on for several types of procedures. Fourteen cases had concomitant double (MVR+TVR) and nine triple (AVR+MVR+TVR) valve replacements. Six of the double and three of the triple replacements were redo cases. One of the deaths was previously operated on for repair of a secundum type atrial septal defect, and another one for repair of the ventricular septal defect.

A 42-year-old woman with Lutembacher syndrome who was operated on for repair of secundum type atrial septal defect (ASD), open mitral commissurotomy, and De Vega annuloplasty of the tricuspid valve developed three years later large tricuspid regurgitation and mitral restenosis. She received a mitral and tricuspid valve, but she died of low cardiac output.

Another woman aged 38 years with ASD secundum and dilated tricuspid valve was operated on for pericardial patch repair of ASD and De Vega annuloplasty. She developed one year later large tricuspid regurgitation and received a bioprosthesis. At present she is alive.

Two young patients (13 and 15 years old, respectively) were operated on for perimembraneous ventricular septal defect (VSD). They developed residual shunt and large tricuspid regurgitation after two years and three years, respectively. They received prosthetic tricuspid valves. The former survived, but the latter died in the early postoperative period because of low cardiac output.

Four cases with Ebstein's anomaly received prosthetic tricuspid valves. Three were females. Among them, one received a Duran ring first, then required a replacement procedure one year later. She further developed rupture of the aneurysm of the non-coronary sinus of Valsalva. She died from mediastinitis and sepsis two months after the third operation. Another patient developed degeneration of the bioprosthesis and underwent a reoperation but died because of pulmonary embolization. The other cases survived.

Eighty-four percent of the cases were followed-up from two months to 121 months with a mean duration of 45±22 months. There were six (8.5%) late deaths during the follow-up period. Actuarial survival rates for 12, 36 and 48 months, including early mortality, were 66%, 52%, and 30%, respectively, with a median survival time of 42 months. The causes of late deaths were infective endocarditis (n=1), right heart failure (n=1), arrhythmia (n=1), valve thrombosis (n=1), pulmonary embolism (n=1) and a sudden death of unknown etiology (n=1).

Four patients underwent reoperation for re-replacement of the prosthetic tricuspid valve, two patients for thrombosis of the mechanical valves (on day 17 and in the fourth year of the first implantation, respectively), one patient for a paravalvular leakage (1 year later) and one for the degeneration of the bioprosthesis four years after the first operation.

Complete heart block developed in 6 (6%) of the cases who subsequently received a permanent pacemaker. Postoperatively, 19% of the cases were in NYHA functional class I, 48% in class II, 28% in class III and 5% in class IV.

In mechanical valve group, best results were obtained with CarboMedics valves (Table 1). However, it was not possible to make a statistically significant interpretation because of the dissimilarities between the different subgroups of mechanical valves.

Among various biological prostheses, best results were obtained with those of Wessex porcine valve (Table 2). Here also, a statistically significant interpretation could not be derived.

When we compare the results of the mechanical and biological valves, early mortality seems to be lower in mechanical valves, whereas mid-term results of the biological valves are more satisfactory (Table 3). However, if we continue to follow-up these patients, long-term results of the new generation mechanical valves may be better.

COMMENT

From a review of the literature on tricuspid valve replacements, early mortality rate is 13% to 30%; the reoperation rate varies from 9% to 31%, the five-year survival is around 50 to 70% and 10-year survival is approximately 40% [1-10].

Table 1. Results of the Mechanical Valves

Valve	Early mortality			Re-replacement		Mid-term mortality	
	(n)	n	%	n	%	n	%
Carbomedics	21	3	14	-		1	5.5
Medtronic	20	4	20	2	12.5	3	18.7
St. Jude	9	4	44	-		.-	
Björk-Shiley	8	2	25	-		1	16.6
Sorin	8	2	25	1	16.6	-	
Hall-Kaster	2	-		-		-	
Omniscience	1	-		-		-	
Total	69	15	21.7	3	5.5	5	9.2

Table 2. Results of the Biological Valves

Valve	Early mortality			Re-replacement		Mid-term mortality	
	(n)	n	%	n	%	n	%
Biocor	18	7	39	1	9	-	
Wessex	7	1	14	-		1	16.6
Hancock	3	1	33	-		-	
Carpentier-Edwards	2	1	50	-		-	
Ionescu-Shiley	1	-		-		-	
Total	31	10	32.2	1	4.7	1	4.7

Table 3. Comparison of Mechanical and Biological Valves

	Mechanical valves (69)		Biologic valves (31)	
	n	%	n	%
Early mortality	15	21.7	10	32.2
Re-replacement	3	5.5	1	4.7
Mid-term mortality	5	9.2	1	4.7

There is agreement that TVR may be indicated when valve repair is not appropriate for pathologic changes of the tricuspid valve. Kawachi et al. mention that high operative mortality and poor long-term survival rate may probably be attributable to multiple valve replacements including TVR [1]. Nearly in all series, the most common cause of early death is right ventricular dysfunction. Preoperative severe right heart failure is usually associated with high early mortality. Preoperative hepatomegaly, ascites and icterus are good predictors of unfavorable postoperative prognosis. On the other hand, most of these patients had concomitant mitral and aortic valve disease and nearly all underwent previous one or more closed - or open-heart surgery, and often presented with advanced stages of functional deterioration [2].·Multiorgan failure and intraoperative bleeding are other causes of early mortality [3].

According to Glower et al. [4], risk factors for late death include preoperative edema, increased aortic cross-clamp time, high pulmonary artery pressure, larger tricuspid valve size, prior cardiac operation, age greater than 55 years, and advanced functional disabitily. ·

In the absence of severe structural damage of the native valve, attempts of repair or annuloplasty should always be made [5]. McGrath et al. reported their ratio of tricuspid valve operation as 5.7% in 9247 valvular heart surgery procedures. Among them, 66%

and 33% were valve repairs and valve replacements, respectively. They also reported secondary intraoperative tricuspid valve replacement because of failed primary repair as 0.75% [2]. In a study of Van Nooten and collaborators, nearly 45% of patients with tricuspid valve disease required valve replacement [5]. In our series of all mitral valve procedures between January 1980 and 1996, the rate of tricuspid valve operation was 26.5% (608/2291) and the rate of tricuspid valve replacement in all tricuspid procedures was 15.5%. According to Ben-Ismail et al. TVR remains essential in chronic organic lesions and in some cases of massive functional tricuspid regurgitation [6].

On the other hand, Goldman and coworkers [11] have recommended the use of intraoperative direct two-dimensional echocardiography to evaluate tricuspid valve function after the repair.

Van Nooten et al. [5] have stated that, bioprostheses in the tricuspid position have a low risk of valve-related events. A large size bioprosthesis should be preferred when TVR is mandatory, however, new mechanical valves may also be used in some particular young patients with good long-term prognosis.

On the basis of their experience, Kawachi et al [1], Guerra and colleagues [7] continue to favor the use of porcine bioprostheses or other tissue valves for TVR even in young adults and in association with mechanical prostheses in the left side of the heart. However, others have argued that a porcine bioprosthesis is structurally unsuitable for TVR because the cusps do not open fully when exposed to a low flow, as occurs in a dilated fibrillating right atrium predisposing to blood stasis. On the other hand, Singh and collaborators [8] support the use of St. Jude valve in tricuspid position. Nakano et al. [3] mention that, in his 14-year follow-up period of 39 adult cases of TVr with St. Jude Medical valve, there was only one thrombosed valve (0.67% per patient-year) under well established anticoagulation, and he gives $80.5\pm6.7\%$ actuarial rate of freedom at 14 years from all valve-related events plus operative and sudden deaths.

McKay et al. [12] reported tricuspid valve replacement using an unstented pericard encircled pulmonary homograft in a 31/2 year-old girl with Ebstein's anomaly.

Finally, the review of the literature reveals two basic questions concerning TVR, one of which, and the more important, is how and when a decision for replacement of a tricuspid valve should be made. All conservative approaches must be tried, and grade 2-3 (+) tricuspid regurgitations may be acceptable, because tricuspid anulus rapidly decreases in size immediately after left-sided heart operations [11]. The latter is which prosthetic valve should be preferred for tricuspid position. Improved hemodynamic peculiarities and durability of the new generation bileaflet mechanical valves support their use in tricuspid position with good long-term results.

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