Türk Kardiyol Dern. Arş. 18: 97-99, 1990

Aortic Valve Replacement in Children

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ÖZET

Çocuklarda Aort Kapak Replasmanı

14 yaşından küçük 83 çocukta aort kapağı değiştirildi; bunların 9'unda aort darlığı eşlik ediyordu. Beşi hariç hepsi erkek olan çocukların 71'i fonksiyonel sınıf III, 12'si sınıf IV te bulunuyordu. Önceleri 15 çocuğa domuz perikardından bioprotez kapak yerleştirilmişken, 1983 yılından beri yalnız mekanik iki-yaprakçıklı (16'sı St. Jude, 52'si Duromedics) kapak implante edildi. Erken postoperatif dönemde üç çocuk kaybedildi (mortalite %3.6). Tromboembolizmi önlemek amacıyla dipyridamole veya aspirin kullanılan tüm çocuklarda, emboli sıklığı hasta-yılı başına %2 bulundu. Aort kapak replasmanına çocuklarda seyrek başvurulduğu için, bu cerrahi deneyim bildirildi.

Anahtar kelimeler: *Aort kapak replasmanı, bioprotez kapak, çocukluk çağı*

Children and pre-teenage patients below 14 years of age constitute about 20% of patients presenting with valvular heart disease in developing countries [1]. Cardiac valve replacement in children involves technical, long-term therapeutic ramifications and social problems that are different from those encountered in the adult population requiring valve replacement [2].

Practical problems of durability, anticoagulation in children (especially in developing countries) outgrowing the prosthesis, potential infective endocarditis, compliance of children to treatment and problems related to childbearing in the female patient, are all important aspects and must be taken into consideration when evaluating a child with severe valvular dysfunction requirinig aortic valve replacement [3].

Received on November 13, 1989
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PATIENTS and METHODS

83 children below the age of 14 years (range from 9-14 years with median age 10.2 years), underwent aortic valve replacement for severe aortic regurgitation (71 children) and combined aortic regurgitation and stenosis (12 children). 12 children were in N.Y.H.A. functional class IV and 71 in functional class III. Only 5 children were female while 78 were male. The etiology of the aortic valve disease was rheumatic fever in 80 patients and infective endocarditis in 3 patients.

EKG showed severe left ventricular hypertrophy in all patients and significant right ventricular hypertrophy in only 12 patients who had additional mitral valve disease requiring concomitant mitral valve surgery. Chest x-ray showed radiographic evidence of significant cardiomegaly and cardiothoracic ratio exceeding 70 % in 81 patients. Echocardiography of M-mode and two-dimensional type was performed in all patients pre - and postoperatively and revealed severe L.V. dilatation with reduction in myocardial shortening in 9 patients of those presenting in N.Y.H.A. class IV.

Cardiac catheterisation with complete right and left heart study was performed in only 22 patients (15 with aortic and mitral valve disease and 7 in children with N.Y.H.A. class IV).

4 children with N.Y.H.A. functional class IV required preoperative ventilatory and cardiotonic support as they presented with severe congestive heart failure and pulmonary oedema. Two of these patients

had clinical (arthralgia and arthritis) and laboratory evidence of rheumatic (high ESR, high antistreptolysin titer (ASO) and positive C-reactive protein). They underwent urgent salvage surgery due to the rheumatic pancarditis.

Cardiopulmonary bypass was instituted by aortic and bicaval cannulation. Oxygenation was achieved by a bubble and membrane type of oxygenators for single or double valve lesions, respectively. Systemic hypothermia to 28°C was routine. Flaccid diastolic arrest was induced by cold cardioplegic solution (12 meq KCl in 500 cc of Ringer lactate) introduced directly into aortic ostiae after aortic clamping. Aortotomy was always performed in an oblique fashion about 2 1/2 - 3 cm above aortic annulus and extended towards non-coronary cusp where it stopped about 1 1/2 - 2 cm above it to avoid tearing during any retraction. The myocardium is additionally protected topically with iced saline poured around the heart in the pericardial well and in the cardiac cativies. Pledgeted (3x3 mm pledgets) non-absorbable sutures (2x0 Ticron) which were inserted in a horizontal mattress fashion were used.

83 aortic valve prostheses were implanted. 15 bioprosthetic pericardial bovine valves were implanted prior to 1983 and 68 mechanical valves of the bileaflet type (16 St. Jude and 52 Duromedic) were implanted from 1983 onwards. 74 patients underwent AVR for severe pure aortic regurgitation (71 rheumatic and 3 infective endocarditis) and 9 children for combined rheumatic aortic regurgitation and aortic stenosis. 15 children had additionally mitral valve lesion. Severe dystrophic aortic valve calcification was found in only 2 patients.

The aortic root was small in 7 patients and an aortic root enlargement through the non-coronary cusp was performed in 6 patients while in 2 it was performed using the R.V. transseptal patch enlargement as described by Konno [4], using a Dacron patch, lined with pericardium. The most commonly used prosthetic valve size was 21 mm (46 patients), and 19 mm (29 patients). Sizes 23 and 25 were implanted in only 8 patients (23 mm in 5 patients, 25 mm in 3 patients) as aortic valve annuli are usually small in Arab patients.

RESULTS

Two patients with advanced left ventricular dilatation due to severe regurgitation died as they could not be weaned from cardiopulmonary bypass. One child with severe infective endocarditis died also during the perioperative period. The hospital mortality rate was 3.6%. Two of the children who had pericardial bovine heterograft valves implanted had progressive stenosis, calcification and dysfunction of the prostheses, occurring 30 and 37 months post implantation. One had to undergo a redo aortic valve replacement where a Duromedic bileaflet valve was implanted. The other patient is being followed up.

Air embolism and mediastinitis have not occured in our series. However, 6 children experienced non-fatal complications (3 superficial wound infection, 2 continous surgical bleeding requiring re-sternotomy and control of mediastinal bleeding. Prosthetic valve endocarditis (P.V.E.) of late onset occurred in only one patient who was successfully managed with antibiotic therapy. Paravalvular leak occurred in one patient necessitating aortic valve replacement.

13 patients were lost to follow-up. 67 children were followed up for a total period of 197 years with a mean follow-up of 2.9 years. The actuarial survival for children undergoing aortic valve replacement using bioprosthetic bovine pericardial valves is 92% after two years and 88% after 5 years. Children who had mechanical aortic prostheses implanted had an actuarial survival rate of 96% and 92% after two and five years, respectively.

The thromboembolism rate for children with bioprosthetic on mechanical bileaflet valves was 2% per patient-year. 86% of the children were event-free at 5 years after aortic valve replacement.

DISCUSSION

Aortic valve replacement can be performed successfully with least morbidity and mortality in children. Bioprosthetic xenograft valves have a high tendency for accelerated calcification, degeneration and dysfunction in children and young adults [5] and should not be used at all in these predispored patient population as calcium precipitation occurs easily even in

spite of use of new generation of bioprosthetic valves treated with anticalcification agents. Bileaflet valves of central flow type such as St. Jude and Duromedic valves give excellent results due to their superior hemodynamic performance, low thrombogenicity and small orifice to aortic annulus ratio [6]. We have therefore implanted only mechanical bileaflet aortic prosthesis in children from 1983.

Full anticoagulation was avoided totally in these children as anticoagulation is difficult to maintain and follow-up and is associated with much morbidity and mortality in developing countries. 79 children were given only antiplatelet agents, such as Dipyridamole (Persantin 75 mg twice daily for 6-12 months). Only two patients had documented transient systemic thromboembolism, who then received full anticoagulation. Prophylactic treatment with antiplatelet agents offers therefore enough protection against thromboembolism in children with aortic and mitral valve replacement as shown by Ebert [7]. The risk of thromboembolism in non-anticoagulated children with mechanical mitral valve prostheses, treated only with antiplatelet agents, as stated by Pass and coworkers [8] is not greater than that seen in anticoagulated children.

Aortic valve replacement in children is merely a palliative and not a corrective procedure. We, therefore, emphasise on the importance of primary prevention of rheumatic fever and the secondary prevention of rheumatic valvular disease which is unfortunately yet inadequate in developing countries. All children with prosthetic valves must be given proper prophylactic coverage when they undergo any dental, genitourinary, gastrointestinal or other procedures. Strict follow-up of all these children is essential and mandatory to evaluate their clinical and hemodynamic condition and to make sure that aortic valve prosthesis is functioning properly, and that the child is not outgrowing it.

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