AORTIC VALVE REPLACEMENT WITH FRESH HOMOGRAFT: MORE THAN 2 YEARS FOLLOW UP

S.H. Ahmadi., H. Mirkhani., M. Rahbar., I. Ghorbandaee., S.H. Shahid Nooraee and H. Radmehr

Department of Cardiac Surgery, School of Medicine, Imam Khomeini Hospital, Tehran University of Medical sciences, Tehran, Iran

Abstract - From May 1994 to December 1996 thirty patients received viable fresh aortic homografts. Mean age was 55 years (13 to 70), male to female ratio was 2/1, 24 operations were elective whereas 6 were semiurgent. Predominant lesions were aortic stenosis or regurgitation in 16 patients, aortic valve endocarditis in 10, prosthetic valve dysfunction in 3, and aortic root pathology in one patient. From technical point of view, aortic root replacement was done in 6 patients, subcoronary in 23, and miniroot in one patient. There was no hospital mortality but one death occured due to congestive heart failure.

Actuarial freedom from endocarditis, reoperations, structural deterioration thromboembolism and other valve complications was 100% (during the follow up of 2 to 30 months). It is concluded that homograft valves or root replacement in selected patients offers low mortality and morbidity with a good life style.

Hemodynamic performance of aortic root replacement is superior than subcronary valve replacement.

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Key words: Aortic valve replacement, fresh homograft

INTRODUCTION

Since the introduction of the first homograft aortic valve replacement by Ross and Barrattboys in 1962 numerous modifications in procurement, preservation and technique have occured (1,2). Homograft valves offer many advantages which include, restoration of normal flow in aortic root, lack of thromboembolism, resistance to infection and no need for anticoagulation and limited durability. The last factor is more important because it necessitates reoperation. Method of procuremnet (3) and implantation technique are the most important determinants of durability (4,5). This study was designed to evaluate the effectiveness of fresh homograft as a satisfactory choice of aortic valve or root replacement.

MATERIALS AND METHODS

Between May 1994 and December 1996, 30 patients received allograft valves using either infracoronary (n = 23), complete or miniroot replacement (n = 7). Twenty three patients had NYHA FC III, 7 had FC IV, 20 patients were men with age 13 to 70 years for the entire group. Indications for operation were primary aortic valve disease aortic stenosis and insufficiency (AS, AI) in 16 patients (53%), prosthetic valve dysfunction in 3 (11%), native valve endocardits in 10 (33%) and aortic root pathology in one patient (Table 1).

Table 1. Pathology of the aortic valve and root

Pathology	n
Rheumatic disease	16
Aortic valve and root endocarditis	10
Prosthetic valve dysfunction	13
Chronic aortic aneurysm	1
Total	30

The valves were procured from Imam Khomeini homograft bank. Homograft valves were harvested under sterile conditions from cadavres. Processing included antibiotic sterilization, placing in tissue culture medium and refregeration at 4°c until utilzed for the planned operation.

Surgical Technique

The infracoronary implantation was used in 23

patients. Homografts were selected 2-3 mm smaller than the measured annular diameter of aorta (5, 6). Whenever annular size exceeded 30 mm in diameter or 3 - 4 mm larger than the largest available homograft (7, 8), root procedure or mechanical valve was selected (Fig. 1).

The proximal sutureline was performed with 3.0 prolene (Fig. 2) . At first, 3 stay sutures were placed immediately beneath the nadir of cusps of aorta and beneath the cusps of homograft inside the ventricle, proximal suture was performed. Then on pulling back the homograft, distal suture line was performed (Fig. 3). For aortic root replacement routine principle was employed (9) (Fig. 4).

Myocaridal preservation was accomplished using antegrade crystalloid cardioplegia with systemic (25°c) and topical cooling. All patients came off the cardiopulmonary by - pass uneventful. Mean cross clamp time was 70 minutes, range (55 - 95) and mean perfusion time was 110 minutes, range (90 - 130). An overview of diameter of the homografts and their implantation mode is given in (Table 2).

Table 2. Overview of implanted diameter of homograft

Diameter	Subcoronary	Root	Miniroot
19	1		
21	5		
22	8		
23	9	4	1
24		2	
25			
26			
27			
28			
Total	23	6	1

Follow up And Data Analysis

Follow up investigation included physical examination, ECG, chest X − Ray and echo doppler. The status of the patients were evaluated every 3 − 6 months consequently. Post operative aortic insufficiency (AI) and gradient was classified as absent, trivial mild, moderate and severe.

RESULTS

Patients' Survival

There was not early mortality, but one late death occured due to congestive heart failure, unrelated to homograft valve. Actuarial survival rate during two and half years follow up was 96.7%.

Thromboembolism

Freedom from thromboembolism was 100%, routine anticoagulant was not used in the series except one patient who had undergone coronary by - pass surgery and homograft AVR., and was given aspirin.

Endocarditis

Endocarditis did not develop after valve implatation in spite of 10 aortic valve endocarditis.

Reoperation

Freedom from reoperation and all valve complications was 100%.

Aortic Valve Incompetence

There were no AI after root replacement. In subcoronary technique, 1 patient had moderate (++) and 3 had mild (+ or trivial) aortic insufficiency. Moderate AI was found in survivor patients with endocarditis due to imperfect geometrical implantation (Table 3). Pressure gradient across the aortic valve homograft was significantly lower for the root replacement group compared with those having subcoronary implantation (Table 4).

Table 3. AI post operation

	early (30 days)	Late (follow up to 30 months)	
subcoronary Tech	Root Tech	subcoronary Tech	Root Tech
AI+ (3 cases)	AI+(trivial) (1 case)	AI+ (3 cases)	no AI
AI++ (1 case)	no	AI++ (1 case)	

Freedom from structural value deterioration (SVD) during the follow up was 100%. No other valve complications were found.

Table 4. Gradient post operation

homograft	mean gradient late post operation		
post op	early post op	after 6months	afer 12months
subcoronary	12 ± 6	10 ± 5	8 ± 5
root replacement	0	0	0

Fig. 1. Different Techniques of homograft AVR

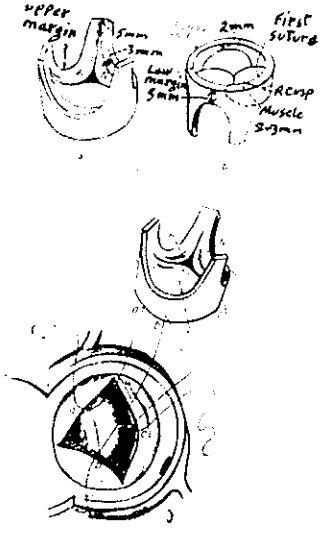


Fig. 2. (a, b) The allograft has been Trimmed (c) 3 sutures have been placed in subcoronery technique

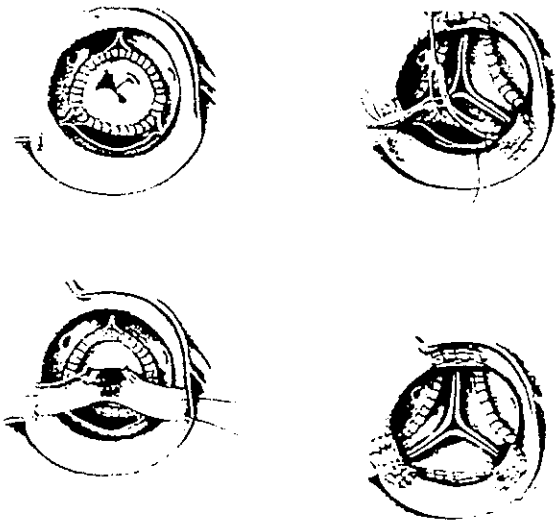
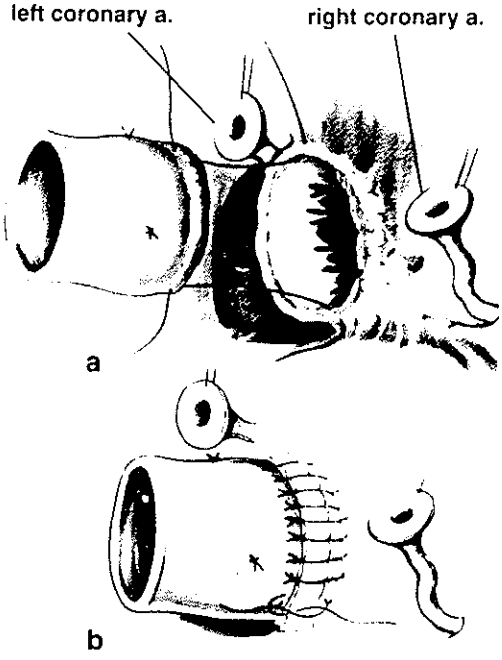


Fig. 3. subcoronery technique



URE 35.33

Fig. 4. Root replacement tehnique

Clinical Status And Functional Class

During the follow up there had been significant improvements in clinical status and functional class.

DISCUSSION

The advantages of homograft are numerous and well known:

1. Negligible incidence of thromboembolism without anticoagulation.
2. Absence of bleeding problem related to anticoagulation.
3. Ability to withstand existing infection at time of implantation.
4. Excellent hemodynamic function (10,11). So aortic homograft valve is a device for young females during child bearing age (12), patients with aortic valve and / or root endocarditis, patients who comply poorly with anticoagulation (peptic ulcer, ulcerativecolitis) (13), those living in remote geographic areas and patients from the poor socioeconomic class.

Two different techniques were used for homograft implantation in our study, firstly: subcoronary technique with scalloping (with or without rotation of sinuses), secondly: complete aortic valve and root or miniroot replacement (ARR) in patients with valve and root diseases.

Aortic root replacement is considered the technique of choice for three reasons. a) It is less likely to get distorted as compared to subcoronary and intraluminal cylinder implantation techniques, b) asymmetry or the host annulus that is often seen with congenital bicuspid aortic valve becomes less important with aortic root replacement, c) matching the allograft size to the host annulus is less critical (9, 14) aortic root replacement is less prone to surgical error.

Mortality rate of ARR is 1.7% and taking back the patients for hemorrhage is 0.7%. Risk of homograft distortion in the subcoronary technique is moderately high with probability of existing various degrees of AI and aortic valve gradients (15, 16, 17). These complications are rare in the ARR technique (18). In our study also the post operative AI and gradient across the aortic valve in ARR was negligible.

The only concern with ARR is the possibility of progressive calcification of graft wall which could subject the aortic valve to additional stress and hence lead to graft failure,but it is common in children (19). Risk factors that influence the homograft degeneration include: method of procurement and preservation, donor and recipient age, aortic root diameter, technique of insertion and faulty free hand inserion. ABO group disparity is not independent risk factor for early degeneration (20, 21, 22, 23, 24).

Cryopreservation, sterile collection, wet storage and homovital technique maintain the viablility of homograft tissue (5, 6). Viability of homograft increases the durability. Investigation revealed that immune response it is little if any (27, 28, 29, 30, 31). In conclusion, the aortic homograft valve and root is a favorable trend in terms of durability and freedom from all valve complications (32, 33).

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