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SURGICAL TREATMENT OF POST MI VSD IN PATIENTS WHO WERE HEMODYNAMICALLY STABILIZED WITH PREOPERATIVE (+) INOTROPS AND IABP

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Post miyokardiyal infarkt (MI) ventriküler septal defekt (VSD) 65 yaş üstü, tek damar hastalığı olan ve ilk kez MI geçiren erkek hastalarda daha sık olarak görülmektedir. Post MI VSD tedavisi cerrahidir. Erken tanı ve hemodinamik stabilizasyonu takiben erken cerrahi müdahale daha başarılı sonuçlar sağlayabilir.

01.01.2000 ile 31.12.2005 tarihileri arasında toplam 17 hasta Post MI VSD tanısı ile operasyona alınmıştır. Bu hastalardan 6'sı (%35.3) kadın ve 11'i (%64,7) erkek idi. Yaş ortalaması 67.2±7.7 (55-78) idi. Hastaların tamamına ameliyat öncesinde koroner anjio yapılmıştır. Hemodinamisi stabil olmayan hastalara ventrikülografi yapılmayıp VSD'nin yeri ekokardiyografik olarak saptanmıştır. Preoperatif dönemde hastaların sol ventrikül ejeksiyon fraksiyonu (EF) değerleri %22 ile %76 arasında değişti (% 45,3±13, 2). Sekiz hasta kardiojenik şok tablosu ile müracaat etti. Bu hastalara derhal (+) inotrop başlandı ve intraortik balon pompası (İABP) yerleştirildi. Post MI VSD oluşumdan operasyona kadar geçen süre VSD'nin ne zaman geliştiği bilinmeyen 1 hasta hariç tutulursa ortalama 19,3±12,4 gün, en yakın 1 gün ve en uzak 45 gün olarak gerçekleşmiştir. VSD oluşumu ile anjio yapılması için geçen süre ortalama 5,2±10,6 gün (1 gün-43 gün) olarak tespit edilmiştir.

Hastaların 8'i kardiyojenik şokta ameliyata alındılar. 10 hastaya preoperatif dönemde intra aortik balon yerleştirildi. Hastalar ortalama 25.5±16.5 saatte ekstübe edildiler. Erken postoperatif dönemde 2 hasta kaybedildi. Hastane mortalitesi % 11.8 olarak gerçekleşti. Kaybedilen iki hastada inferior septum da VSD tanısı ile ameliyata alınmışlardı. Hastalar ortalama 4.3±2.2 günde (2-7 gün) servise çıkarıldılar. Serviste sorunsuz seyreden hastalar ortalama 9.2±3.2 gün de (6-14 gün) taburcu edildiler. Postop eko kontrolünde hiçbir hastada residuel kaçak tespit edilmedi.

Sonuç olarak yaygın miyokard infarktüsü sonucu meydana gelen ve geniş miyokard hasarı birlikte olduğu post MI VSD olgularında ameliyat öncesi dönemde kardiyojenik şoktaki hastalarda intraaortik balon pompası desteği önemlidir. Pozitif inotrop + IAB desteği ile hemodinamik stabilizasyon sağlanan hastalarda elektif şartlarda operasyon daha başarılı sonuçların elde edilmesini sağlamaktadır.

Anahtar kelimer: Post MI VSD, Cerrahi, IABP

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INTRODUCTION

Post Myocardial Infarct Ventricular Septal Defect (Post MI VSD) is a complication that is seen in 1-2% of patients who suffered acute myocardial infarction (MI) and always together with transmural MI[1-2].

Post MI VSD is seen more frequently in over 65 years old males who have single vessel disease and suffer MI for the first time[3]. In natural course of Post MI VSD, 80 % of patients die in 2-3 months. Death rate is especially higher in first ten days[4]. Post MI VSD cases have decreased in last decade due to widespread applications of invasive cardiologic interventions and new thrombolytic agents. Newly developed pansystolic murmur, biventricular failure, and shock are typical features of the Post MI VSD. Treatment approach of the Post MI VSD is surgical. Emergent intervention and repair in first 2-3 weeks is eventuated with mortality rate over than 60%[5-6]. Immediate surgical intervention following early diagnosis and hemodynamical stabilization may bring out more successful results.

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Table 1: Demographic data, localization of preoperative MI and VSD, and preoperative EF scores of cases.

Case	Gender	Age	MI Localization	VSD Localization	Aneurysm	Thrombus	Preop. EF (%)
1	M	62	Anterior	Anteroseptal	Apical	-	50
2	F	75	Anterior	Anteroseptal	Apical	-	46
3	M	58	Inferior	Posterobazal	-	-	76
4	M	67	Anterior	Anteroseptal	Apical	+	36
5	F	57	Anterior	Anteroseptal	-	-	40
6	F	72	Antero-lateral	Anteroseptal	Apical	-	22
7	M	71	Inferior	Posterobasal	-	+	30
8	M	61	Inferior	Posterobasal	-	-	50
9	M	73	Anterior	Apical	Apical	-	50
10	M	55	Inferior	Posterior	-	-	50
11	M	65	Inferior	Posterior	-	-	40
12	M	60	Inferior	Inferoposterior	-	-	55
13	F	76	Anterior	Apical	-	-	47
14	M	78	Anterior	Apical	-	-	40
15	M	77	Anterior	Apical	-	-	44
16	F	67	Anterior	Apical	-	-	25
17	F	68	Anterior	Apical	Apical	+	59

MATERIAL and METHOD

Between 01/01/2000-31/12/2005, 17 patients underwent surgery because of Post MI VSD in our center. Six of 17 patients were female (35.3%) and 11 (64,7%) male. Mean age was 67.2±7.7 (55-78) years. Ten patients had suffered anterior MI, 6 patients had suffered inferior MI, and remaining 1 patient had suffered anteroseptal MI. VSD localizations were apical, anteroseptal, posterobasal, posterior, and inferoposterior in 6, 5, 3, 2, 1 patients, respectively. There was left ventricular aneurysm in 6 patients. There was also left ventricular thrombus in 3 patients those 2 of them had left ventricular aneurysm and remaining 1 patient had no aneurysmal change (Table 1). Coronary angiography was performed to all cases preoperatively. Ventriculography was not performed to patients whose hemodynamic situation was unstable. Localization of VSD was determined by echocardiography in these patients. Preoperative EF scores were between 22% to 76% (mean 45,3%±13, 2).

Preoperative coronary angiographies showed that there were two-vessel disease, single-vessel disease, three-vessel disease, and left main coronary artery disease in 7, 5, 4, and 1 patients, respectively. Degree of the vessel lesions according to angiographies were shown in (Table 2). Right coronary artery (RCA) was totally occluded in 6 patients who had posterior, inferoposterior, and posterobasal VSDs. Moreover, there was significant left anterior descending (LAD) artery lesion in all of the posterior VSD patients. RCA was involved and narrowness was significant in 4 of 11 patients who had apical or anteroseptal VSD. Nonetheless, there was not RCA involvement in other 2 patients. Five patients had isolate LAD involvement.

VSD was determined incidentally in 1 of the 17 patients underwent surgery due to Post MI VSD. Hemodynamic status of this case was stable. His angiography was performed on his admittance and operated electively. One patient was discharged of his own accord although Post MI VSD was determined and emergent operation was offered. However, this patient admitted our center with congestive heart failure and was operated emergently. Other 7 patients were hemodynamically stable when they admitted. Angiographies of these patients were performed in same day, and all were operated electively.

Remaining 8 patients admitted with cardiogenic shock. Positive inotropic agents were started and intraaortic balloon pump (IABP) was inserted immediately. Temporary pace-maker was inserted to a patient preoperatively who had complete AV block. Salvation PTCA to involved vessel was performed in 2 patients. Situation of 1 of these patients was stabilized and operated in proper time. Other patient was operated emergently in 3rd day due to his hemodynamic status was not stabilized and the leg ischemia developed because of inserted IABP catheter.

Except of 1 patient whose occurring time of VSD is unknown, the mean interval between the onset of Post MI VSD and surgical procedure was 19,3±12,4 days (1 day-45 days); the mean period between VSD occurence and angiography was 5,2±10,6 days (1 day-43 days) in remaining 16 patients.

Table 2: Distribution of coronary lesions according to coronary angiography, distribution of coronary anastomosises, and approach to VSD

Case	Coronary Angiography Evaluation	Coronary Bypass	Aneurysmectomy	Approach to VSD
1	LMCA: %80, LAD: %95, İM: %70	IMA-LAD, Saphenous-İM	Apical plication	Left Ventricle, Goretex Patch + Teflon Felt
2	LAD: %100, IM: %75, RCA: %70	Saphenous - IM, Saphenous - RCA,	Apical Amputation	Left Ventricle
3	LAD: %50 - 60, RCA: %100	Saphenous - LAD, Saphenous RCA	-	Right atrium, Goretex Patch
4	LAD: %100	Saphenous - LAD	Endoaneurysmaoraphy	Left Ventricle
5	LAD: %100	-	-	Left Ventricle, Goretex Patch + Teflon Felt
6	LAD: %100, RCA: %50 - 60	Saphenous - RCA	Apical plication	Left Ventricle, Goretex Patch + Teflon Felt
7	LAD: %85, Cx: %85, RCA: %100	IMA - LAD, Saphenous - RCA, Saphenous - CX	-	Right Ventricle, Dacron Patch + Teflon Felt
8	LAD: % 100, Cx OM2: %60, RCA: %100	Saphenous - LAD, Saphenous - Cx	-	Right Ventricle, Teflon Felt
9	LAD: %100, Cx OM2: %90	-	Endoaneurysmoraphy	Left Ventricle, Teflon Felt
10	LAD: %99, RCA: %100	Saphenous - Cx	-	Left Ventricle, Dacron Patch
11	LAD: %100, CX: %60, RCA: %100	Saphenous - LAD, Saphenous - RCA, Saphenous - Cx, Saphenous - IM	-	Right Ventricle, Teflon Felt
12	LAD: %95, Cx OM1: %100	Saphenous - LAD	-	Left Ventricle, Pericardial Patch + Teflon Felt
13	LAD: %98, RCA: %50	Saphenous - LAD, Saphenous - RCA	Endoaneurysmoraphy	Left Ventricle
14	LAD: %100, Cx OM2: %50, RCA: %40	Saphenous - RCA	-	Left Ventricle, Goretex Patch, Teflon felt
15	LAD: %50	Saphenous - LAD	-	Left Ventricle, Goretex Patch, Teflon felt
16	LAD: %100	Saphenous - LAD	-	Left Ventricle, Goretex Patch, Teflon felt
17	LAD: %100	Saphenous - LAD	Apical plication	Left Ventricle, Dacron Patch

LMCA: Left Main Coronary Artery, LAD: Left Anterior Descending Artery, RCA: Right Coronary Artery, IM: Intermedius Branch, Cx: Circumflex artery, OM: Obtuse Marginal Branch, IMA: Internal Mamarian Artery

Table 3: Time interval between VSD diagnosis and angiography/operation time, and preoperative hemodynamic futures of the cases

	VSD development-Operation day	Cardiogenic Shock	Preop. IABP	Preop. (+) Inotrop	VSD-Angiog. Interval	Salvage PTCA	Emergent Entubation	PACE
1	28. day	-	-	-	1 day	-	-	-
2	29. day	-	-	+	1 day	-	-	-
3	16. day	+	+	+	6 day	-	-	-
4	?	-	-	-	?	-	-	-
5	17. day	+	+	+	1 day	+	+	-
6	3. day	+	+	+	1 day	+	+	-
7	17. day	+	+	+	12 day	-	-	+
8	21. day	-	+	+	2 day	-	-	-
9	20. day	-	-	-	7 day	-	-	-
10	12. day	-	-	-	2 day	-	-	-
11	10. day	+	+	+	1 day	-	-	-
12	16. day	+	+	+	2 day	-	-	-
13	42. day	+	+	+	1 day	-	-	-
14	7. day	-	+	+	1 day	-	-	-
15	45. day	-	-	-	43 day	-	-	-
16	1. day	+	+	+	1 day	-	-	-
17	6. day	+	+	+	1 day	-	-	-

OPERATION TECHNIQUE

Standard median sternotomy was applied to all patients. Cardiopulmonary bypass (CPB) was initiated after ascending aortic and bicaval venous cannulation. Cardioplegic arrest was achieved by antegrad cold blood cardioplegy. Retrograde hot blood cardioplegy was given just before opening the cross clamp. Patients' bodies were moderately cooled. Coronary bypasses were performed before VSD closure if saphenous graft will be used for anastomosis. Maintenance of cardioplegic arrest was provided by cold blood cardioplegy via saphenous grafts. However if internal mammarian artery (IMA) was used as graft, IMA anastomosis was carried out after VSD closure. Left ventricle was opened with a parallel incision to LAD in aneurysm or infarct area in patients who have apical aneurysm and/or apical VSD. VSD was closed by PTFE or Dacron patches with 5/0 propylen sutures. Sutures were passed one by one in " U " shape and were supplied with Teflon felts. Ventriculotomy was closed or aneurysmectomy was applied using linear plication technique with sutures supported by Teflon felt strips. In 1 patient who had apical aneurysm, apical amputation was performed and ventriculotomy was closed with Teflon felts such as inclosing VSD. VSD was closed with endoaneurysmoraphy technique in 3 patients who had apical or anteroseptal VSD. We reached VSD of 6 patients whose VSDs were located in posterior septum from right ventricle, left ventricle, and right atrium in 3, 2, and 1 patients, respectively. VSD was closed with pericardial patch in 1 patient and PTFE or Dacron patches were used in remaining 5 patients. Ventriculotomy was closed with Teflon felt strips.

In addition to VSD repair, coronary bypass was applied to 15 of 17 patients. At least 1 and at most 4 distal anastomosis were performed (Mean distal anastomosis: 1.47±1). VSD closure and aneurysmectomy was applied to 1 patient without coronary bypass. Only VSD closure was applied to 1 patient. Left ventricular thrombus was cleaned in 3 patients. Left femoral embolectomy was performed to 1 patient because of left lower extremity thromboembolism.

RESULTS

Eight of the patients underwent operation in cardiogenic shock. IABP was inserted to 10 patients preoperatively. Positive inotripic agents were initiated in 11 patients. Two patients in cardiogenic shock were entubated due to respiratory worsening. Coronary angiographies of these patients were performed with ventilator. In 7 patients, IABP was needed postoperatively. Except of 1 patient, positive inotropic agents were initiated postoperatively or continued to preoperatively initiated drugs in all patients. Patients were extubated in 25.5±16.5 hours (12h- 64h). One patient who could not be extubated died in 4th day. One patient who was extubated in 3rd day and re-entubated in 7th day due to respiratory worsening died in 23rd day. Seven of the 17 patients could be weaned from CPB by IABP support. IABPs were pulled out on 2nd day. Nine patients needed only positive inotropic agents for weaning from CPB. Only 1 patient were weaned from CPB without any support. Two patients

Table 4: Postoperative hemodynamic data of the cases.

	Postop. IABP	Postop.(+) Inotrop	Extubation	Discharge from ICU	Discharge from Hospital	Exitus
1	-	+	16. hour	2. day	7. day	-
2	-	-	20. hour	2. day	6. day	-
3	+	+	18. hour	3. day	6. day	-
4	-	+	17. hour	3. day	8. day	-
5	-	+	12. hour	2. day	6. day	-
6	-	+	-	-	-	4. day
7	-	+	40. hour	3. day	13. day	-
8	-	+	1. day	2. day	6. day	-
9	-	+	1. day	3. day	7. day	-
10	-	+	1. day	2. day	6. day	-
11	+	+	3. day	7. day	-	23. day
12	+	+	1. day	4. day	9. day	-
13	+	+	1. day	5. day	7. day	-
14	+	+	4. day	7. day	14. day	-
15	-	+	1. day	3. day	6. day	-
16	+	+	1. day	8. day	12. day	-
17	+	+	1. day	3. day	7. day	-

died in early postoperative period. In-hospital mortality rate was 11.8%. Both of the patients had been operated due to VSD localized in inferior septum. Patients were discharged from intensive care unit (ICU) to service room in 4.3±2.2 days (2-7 days). Patients who had uneventful course were discharged from the hospital in 9.2±3.2 days (6-14 days).

Acute renal failure developed in 1 patient in postoperative period. After 3 consecutive hemodialysis, renal functions were improved and patient was discharged on 13rd day. One patient who was operated due to inferior VSD and taken to the service room on 7th day, was retaken to the ICU and re-entubated due to respiratory worsening. Patient died on 23rd day because of low cardiac output. Remaining 15 patients were followed up uneventfully in postoperative period. All of alive patients were checked by echocardiography. No residual defect was determined.

DISCUSSION

Post MI VSD frequency is about 1-2% according to autopsies. Epidemiologic studies show that Post MI VSD is seen more frequently in >65 years old males who have single vessel disease and suffer MI for the first time[3]. Therefore, collateral circulation is rare in these patients.

Newly developed pansystolic murmur heard on left border of the sternum, hemodynamic instability, and cardiogenic shock findings in patients who were interned to hospital with acute MI are high index of suspicion of the Post MI VSD. Whereas the localization of the VSD is apical area of the septum in 60 % of cases, it is seen in posterior septum after inferior MI in 20-40 % of cases.

Echocardiography is an early and reliable method in diagnosis of Post MI VSD. Presence and localization of septal rupture is easily assessed by newly developed Doppler Echocardiography and Transoesephageal Echocardiography. According to Smyllie et al., Doppler Echocardiography is 100 % specific and sensitive to distinguish VSD from severe acute mitral insufficiency[10]. However left heart catheterization shows the location of the coronary artery lesion, left ventricular wall movements, and valve dysfunctions, necessity of left ventriculography when performing coronary angiography is controversial.

Diagnosis of all patients in our study was achieved by echocardiography. At the same time, coronary angiography was performed to all patients. During coronary angiography, if patient is not hemodynamically stable, left ventriculography was not performed. Location of the VSD was determined by echocardiography. IABP was immediately inserted to 8 patients who admitted with cardiogenic shock. Coronary angiographies were performed later in patients who were hemodynamically stabilized, whereas 2 patients who were entubated due to respiratory worsening were taken angiography laboratory as entubated and performed coronary angiography. Salvation PTCA was applied to 2 patients during angiography. Situation of 1 of these patients was stabilized and operated in proper time. Other patient was operated emergently in 3rd day due to his hemodynamic status was not stabilized and the leg

ischemia developed because of inserted IABP catheter.

Acute MI and related complications course lethal unless they were treated. If Post MI VSD was not treated surgically and followed up by medically, mortality rate for first month is 80%. Due to early mortality rate is high in medical therapy, surgical intervention to treat this complication has to be considered as first option[11].

It is also controversial that when Post MI VSDs should be operated after diagnosis. Diagnosing of Post MI VSD is a certain operation indication. Hemodynamic situation of the patient should be stabilized to ascertain optimal operation time and to perform other diagnostic studies. Therefore, shunt from left to right and systemic vascular resistance should be decreased, peripheric organ and coronary perfusion and cardiac output should be increased. All of these parameters are best provided by IABP.

Studies show that long term survival rates are better in whose involved vessel was treated via coronary bypass[12-13]. Coronary bypasses obviate recurrent infarcts and so give occasion positive long term results[14]. We did not perform coronary bypass only 2 of 17 patients in our series because of LAD was in aneurysm area. We believe that in addition to VSD closure, performing coronary bypass affects the long term results positively.

Ventricular aneurysm is seen about 12% in patients who suffered acute MI. This rate is 35-68% in surviving Post MI VSD cases. There were apical aneurysm in 6 of our 17 patients and we performed them aneurysmectomy.

Risk factors that affect operative mortality in Post MI VSD cases are advanced age, preoperative low ejection fraction, anatomic localization of VSD, timing of operation, presence of preoperative shock, and right heart failure findings.

Although some investigators in 1970s recommend early surgical intervention, another part of investigators did not suggest early surgical intervention if hemodynamic status is good and there is a well response to medical support therapy. Presence of congestive heart failure, increased BUN levels, and decreased urinary output require aggressive treatment and emergent surgery. Patients who have septal rupture rarely die due to congestive heart failure. The main death reason is frequently multiorgan failure related to shock. Early surgical intervention is the necessary treatment option to shorten shock duration.

As a result, surgical treatment of Post MI VSD which is together with large myocardial damage related to MI still has high mortality and morbidity rates. Preoperative IABP support is key point in patients who are in cardiogenic shock. Elective operation following stabilization of hemodynamic status of the patient via positive inotropic agents and IABP leads more successful results.

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