Perforation of Interventricular Septum in Acute Myocardial Infarction

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Abstract

Eight cases of ruptured interventricular septum associated with myocardial infarction were diagnosed at Siriraj Hospital between 1985 - 1995. Clinical congestive heart failure and holosystolic murmur were found in all. Diagnosis was confirmed by echocardiogram and right heart catheterization in all patients. Two patients died from congestive heart failure preoperatively and the third case died from organ failure and sepsis postoperatively. Another five cases underwent successful ventricular septal defect closure and coronary artery bypass with good results.

Prior to the successful surgical repair by Cooley et al in 1957, the diagnosis of perforation of the interventricular septum in the course of acute myocardial infarction was only a clinical and pathological curiousity. Most patients died from intractable heart failure or cardiogenic shock. With the advance in surgical techniques many lives have been saved. For successful surgical intervention, however, a definitive diagnosis and precise localization of the interventricular defect is essential. Before cardiac catheterization and angiography are performed, the diagnosis must be established by clinical data and bedside investigative means. We report eight cases of interventricular septal perforation complicating acute myocardial infarction in Siriraj Hospital.

MATERIAL AND METHOD

From 1985 to 1995, 459 patients were admitted to Siriraj Hospital Cardiac Care Unit for the treatment of acute myocardial infarction. Eight patients had perforation of the interventricular septum. The diagnosis was made on the basis of clinical findings, echocardiographic examination and bedside right heart catheterization.

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RESULTS

The patients' profile and clinical findings are summarized in Table 1. There were 5 men and 3 women with the age range of 54 - 70 years. Five patients had a history of hypertension and two were diabetic. The chest pain was mild to severe in intensity. Holosystolic murmur grade 3/6 without thrill was best audible over the left lower sternal border or apical area in all cases. Table 2 summarizes the electrocardiographic, echocardiographic findings and the results of the right heart catheterization. Seven patients had acute anterior wall infarction and one also had involvement of inferior wall and another had left ventricular aneurysm.

Table 1. The patient profile and clinical findings.

Patient No.	Age yr.	Sex	B.P. mmHg	Pulse /min	Resp./min	CHF	Cardiac findings
1	66	F	86/66	100	32	yes	Grade 3/6 HSM, at LLSB.
2	68	F	90/60	100	30	yes	Grade 3/6 HSM, over precordium, S_3, S_4.
3	70	M	130/80	120	30	yes	Grade 3/6 HSM, over precordium.
4	54	M	120/80	100	28	yes	Grade 3/6 HSM, at left 3rd, 4th, ICS, S_3,
5	65	M	100/80	120	26	yes	Grade 3/6 HSM, at apex, LLSB, S_3
6	60	M	80/60	140	28	yes	Grade 3/6 HSM, at LLSB.
7	62	F	112/79	89	24	yes	Grade 3/6 HSM, at LLSB.
8	59	M	90/64	106	20	yes	Grade 3/6 HSM, at LLSB.

Abbrevations: HSM = holosystolic murmur, ICS = intercostal space, LLSB = lower left sternal border, S_2 = second heart sound, S_3 = third hear sond, S_4 = fourth heart sound.

Table 2. Electrocardiographic, echocardiographic and right heart catheterization data.

Patient No.	Electrocardiogram	Echocardiogram	Rt. heart catheterization					
			Pressure (mmHg)			Oximetry (%)		
			mRA	RV	PAW	RA	RV	PA
1.	Marked LAD, Complete RBBB, acute ALMI.	2 cm. IVS defect	10	33/6	25	72	84	92
2.	Acute ALMI, acute IMI	Echo-free area in RV apex after contrast injection.	23	55/18	28	56	88	92
3.	Complete RBBB (old), acute ASMI, old IMI	Perforation of IVS near apex	19	44/18	23	63	86	95
4.	ALMI with persistent elevation of ST-segment	Perforation of IVS near apex, aneurysm of anterior LV wall.	3	35/4	17	78	89	95
5.	Acute IMI	Perforation IVS near posteromedial papillary muscle	10	57/7	14	57	94	96
6.	Complete RBBB, atrial fibrillation Acute ASMI, recent IMI	2.5 x 1.5 cm at inferoapical area	16	44/14	18	71	77	93
7.	Acute extensive anterior MI	Perforation of IVS at near apex	10	50/16	20	64	88	88
8.	Recent anteroseptal MI	Large VSD at mid apical region	-	-	-	-	-	-

Abbrevations: ALMI = anterolateral wall myocardial infarction, ASMI = anteroseptal myocardial infarction, IMI = inferior wall myocardial infarction, IVS = interventricular septum, LAD = left axis deviation, m = mean pressure, PAW = pulmonary artery wedge, RA = right atrium, RV = right ventricle, RBBB = right bundle branch block.

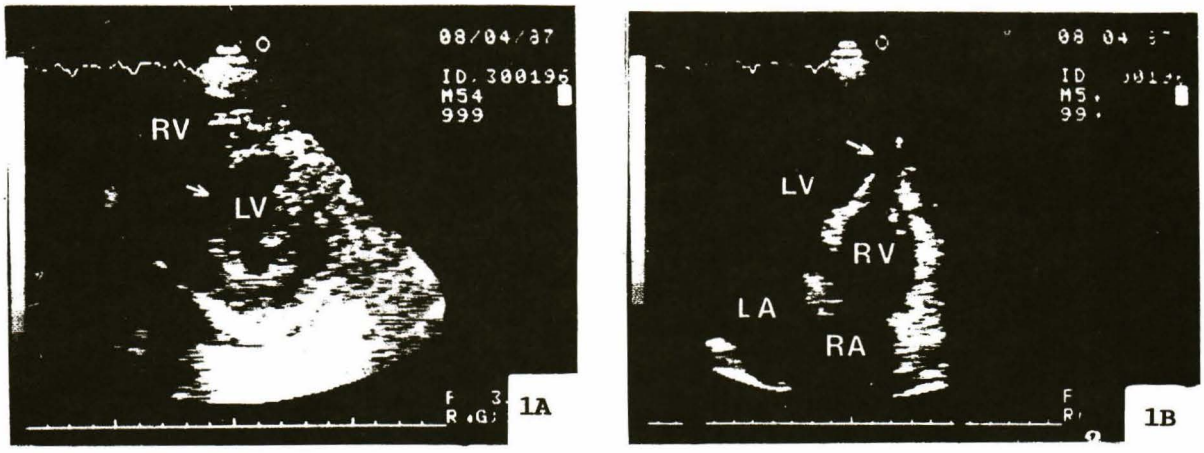

Fig. 1. 2D - echocardiogram from patient number 4 showed ruptured of apical septum (arrow), in short axis (A), and apical four chamber view (B).

Table 3. Outcome.

Patient No.	Surgery	AMI to surgery (Day)	Outcome
1	None	-	CHF, expired
2	None	-	CHF, expired
3	IVS closure	16	Sepsis, expired
4	IVS closure, CABG*	60	alive
5	IVS closure, CABG	10	alive
6	IVS closure, CABG	15	alive
7	IVS closure, CABG*	-	alive
8	IVS closure, CABG	30	alive

* LV aneurysmectomy

Abbrevations: CHF = congestive heart failure, IVS = interventricular septal defect, CABG = coronary artery bypass graft

The chest roentgenograms revealed marked cardiomegaly with pulmonary congestion in all cases. Two dimensional echocardiographic examination showed perforation of the septum in all (Fig. 1). In seven cases the lesions were confined to the area near both ventricular apices, while one patient had perforation near the posteromedial papillary muscle. The right heart catheterization by flow directed balloon-tipped catheter in 6 patients showed left to right shunting of blood at ventricular level. The first two patients succumbed from progressive hypotension and heart failure (Table 3). The third patient underwent surgical closure of interventricular defect 16 days after the onset of acute myocardial infraction complicated by sepsis, organ failure and expired. The last 5 patients underwent cardiac catheterization and coronary arteriography and had successful closure of the defect and saphenous vein bypass grafts. Two patients also had left ventricular aneurysmectomy.

DISCUSSION

Development of precordial systolic murmur in the course of acute myocardial infarction is common. In most of the patients, the murmur is insignificant, transient or persistent. Diagnosis of its underlying cause is uncertain in the majority of them. Some patients develop murmur due to serious anatomical derangement secondary to infarction such as papillary muscle dysfunction or perfora-

tion of the interventricular septum. The last event although rare and accounting for only 1.3 per cent from post mortem studies are not uncommonly reported in the literature[1,2]. This complication carries a very poor prognosis[3-5]. Twenty four per cent die in 24 hour, 65 per cent within 2 weeks, and 82 per cent within 2 months and only 7 per cent of the patients survive for 1 year or longer[3]. This high mortality rate is a consequence of left to right shunting of blood placing a severe hemodynamic burden upon already damaged left ventricle from ischemia or infarcted muscle[6]. Perforation of the interventricular septum is frequently fatal but in some instances patients may survive for many years[7]. The time interval from the onset of infarction to septal perforation is 0.5 - 14 days (average 10 days) and the most frequent site of rupture is the anterior-apical muscular septum, resulting from the higher incidence of anterior and anteroseptal myocardial infarction. Survival without surgical correction of the defect varies from 0.5 - 52 days (average 8 days). In the present series almost all patients were elderly, the majority were male. All of them had heart failure and some had hypotension.

Clinical diagnostic uncertainty is encountered on the basis of murmur between perforated septum and ruptured papillary muscle. The latter findings are rare and occur in less than 0.5 per cent of patients dying from myocardial infarction. The location of murmur is usually not a distinguishing feature since it is a loud holosystolic murmur radiating well over the entire precordium and left sternal border in both instances[6,8,9]. All of our patients had holosystolic murmur of moderate intensity and confined to the apical area or left lower sternal border or both. Although it was reported to be present in only 50 - 60 per cent of the cases, thrill was absent in all of our patients[8].

Early in the current series, some patients were initially treated conservatively in the hope that friable acutely infarcted myocardium would better organize and thereby facilitate surgical repair. This approach resulted in the death of patients who probably could have been saved by prompt closure of the defect. Furthermore, any delay in surgical operation is often attended by development of multiorgan failure and attempt at ventricular septal defect closure is then often ill-fated[23-25] Pioneered by Cooley et al in 1957, many patients underwent emergency surgical repair with impressive success[10]. Many of them survived and had a good quality of life for a number of years. Thus, current reports have emphasized the desirability of early operation in these clinically unstable and usually worsening patients[11,12]. Before surgical intervention, however, precise diagnosis and localization of the perforation is essential and could be done by invasive or none-invasive procedures. Blood samples in various cardiac chambers and pulmonary artery are obtained by a flow directed balloon tipped catheterization. Step up of oxygen saturation in the down stream of blood flow confirm the clinical diagnosis of interventricular septal perforation. Pressure tracings are also recorded and could be analysed to diagnose mitral regurgitation due to papillary muscle dysfunction or rupture of the interventricular septum with certainty[13]. The interventricular septal defect could be vistualized by two dimensional echocardiographic examination and Doppler technique[14-17,26] (Fig. 1). Radionuclide scanning or angiography could establish ventricular anatomy, function and interventricular septum [18,19]. When the diagnosis is established by either procedure or all of them and when the surgical repair is comtemplated, the patient may be further evaluated by cardiac catheterization and coronary arteriography with intra-aortic balloon instituted[20-22] if needed. In our series, the first two patients succumbed to heart failure. The third was probably late for surgical intervention and died from sepsis and organ failure after closure of the interventricular defect. The last five patients underwent successful surgical closure of the interventricular defect, aorto-coronary bypass with saphenous vein grafting and two also had left ventricular aneurysmectomy, All these five patients survived and were discharged in satisfactory condition.

SUMMARY

Rupture of interventricular septum following acute myocardial infaction is rare but has detrimental effects if not treated appropriately. Doppler echocardiography is useful for making this diagnosis, as well as for evaluating acute mitral regurgitation that may have a similar clinical presentation. Surgery is a treatment of choice, and current reports have emphasized early operation in patients who are clinically unstable and worsening.

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การทะลุของผนังกั้นเวนตริเคิลในผู้ป่วยกล้ามเนื้อหัวใจตายแบบเฉียบพลัน

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จากผู้ป่วย 459 ราย ที่มีกล้ามเนื้อหัวใจตายแบบเฉียบพลัน และรับไว้รักษาในหออภิบาลผู้ป่วยโรคหัวใจ โรงพยาบาลศิริราช ระหว่างปี พ.ศ. 2528 – 2538 พบว่า 8 ราย มีการทะลุของผนังกั้นเวนตริเคิลร่วมด้วย เป็นชาย 5 ราย, หญิง 3 ราย, 6 ราย มีอายุตั้งแต่ 60 ปีขึ้นไป การตายของกล้ามเนื้อหัวใจแบบเฉียบพลันเกิดที่บริเวณ anterolateral 3 ราย, anteroseptal 3 ราย, anterolateral และ inferior 1 ราย, inferior 1 ราย, 2 ราย มี old infarction ร่วมด้วย ผู้ป่วยทุกรายมีอาการหัวใจวาย, บางรายมีความดันเลือดต่ำร่วมด้วย ทั้ง 8 ราย มี holosystolic murmur ดังขนาดปานกลาง ฟังได้ที่ apex ของหัวใจหรือบริเวณล่างซ้ายของ sternum หรือทั้งสองแห่ง ไม่พบว่าผู้ใดมี thrills เลย การตรวจหัวใจด้วยคลื่นเสียงเหนือโสต และการสวนหัวใจซีกขวาว่ามีการแตกทะลุของผนังกั้นเวนตริเคิล ผู้ป่วย 2 รายแรกถึงแก่กรรมจากหัวใจวาย โดยไม่ได้รับการผ่าตัด รายที่สามถึงแก่กรรมจาก organ failure และ sepsis หลังผ่าตัดปิดรูรั่ว 5 รายสุดท้ายได้รับการผ่าตัดปิดรูทะลุและต่อหลอดเลือดหัวใจ (coronary artery bypass) อาการหัวใจวายหายไป สามารถจำหน่ายผู้ป่วยจากโรงพยาบาล ผลการติดตามตรวจเป็นระยะ ๆ พบว่าทุกรายสบายดี

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