Long-term prognosis after acute anterior infarction with atrioventricular block

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The purpose of this study was to evaluate the need for permanent pacing in patients who have survived the effects of anterior myocardial infarction with complete heart block and have returned to sinus rhythm but who are left with impairment of intraventricular conduction. We have reviewed 52 patients with complete heart block complicating recent anterior myocardial infarction. Temporary pacing was instituted in all patients. There were 25 hospital survivors who were followed for an average of 49 months. Long-term pacing was established in 4 patients. Of the 21 patients in sinus rhythm, 14 had partial bilateral bundle-branch block with either right bundle-branch block and left anterior hemiblock or right bundle-branch block and left posterior hemiblock; at the end of the follow-up period, 10 of these 14 were alive and well. Furthermore, permanent pacing failed to prevent sudden death in 2 patients. At the present time, therefore, we conclude that long-term pacing is not justified in patients, otherwise asymptomatic, with partial bilateral bundle-branch block persisting after transient complete heart block in anterior myocardial infarction.

Survivors from acute anterior infarction complicated by complete heart block usually return to sinus rhythm after a few days, but most are left with electrocardiographic evidence of bifascicular block, sometimes with additional prolongation of the PR interval. In view of the fact that atrioventricular conduction may be precarious and that coronary disease is by nature progressive, there is a case for installation of a demand pacing system. On the other hand, competition or excessive power of stimulation could produce fatal ventricular fibrillation. Furthermore, endocardial potentials necessary for appropriate function of the demand pacemaker may be reduced in these patients who have almost invariably had a very large infarct. For this reason, we have been reluctant to use a pacemaker in such cases and now give the results of a follow-up averaging 49 months in a group of 25 patients.

Methods

The medical records and standard 12-lead electrocardiograms of 52 patients admitted to our care in the 10-year period up to December 1973 were

reviewed. All had been referred with recent anterior myocardial infarction complicated by the development of complete heart block. It was not known whether there was pre-existing fascicular block before infarction. In 2 patients (Cases 3 and 6) a narrow QRS in the presence of complete heart block suggested proximal atrioventricular block. In all other patients the level of the block was considered to be distal in site because of the slow rate of the escape pacemaker and a QRS width of at least 0.12 s. All patients needed temporary pacing.

The diagnosis of acute myocardial infarction was established by a typical history accompanied by characteristic enzyme rises and the development of pathological Q waves accompanied by ST segment and T wave changes in the anterior chest leads. Bundle-branch block was defined according to the criteria of Goldman (1967) and the criteria for hemiblock were those of Rosenbaum (1970). Partial bilateral bundle-branch block was defined as right bundle-branch block and left anterior hemiblock or right bundle-branch block and left posterior hemiblock.

The usual hospital stay was at least 3 weeks and follow-up observations were obtained in all patients. His bundle electrograms were recorded in 8 patients after return to sinus rhythm, using the technique described by Scherlag *et al.* (1969).

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Results

Of the 52 patients 27 died in hospital, giving a mortality of 52 per cent. The majority of deaths in hospital were the result of myocardial failure. Four patients developed ventricular fibrillation despite pacing, 1 patient had a further infarct, and 1 patient who had returned to sinus rhythm with right bundle-branch block and left anterior hemiblock within 24 hours of infarction died suddenly 2 weeks after admission (Table 1).

The 25 survivors, with ages ranging from 36 to 78 years (mean 60 years), who left hospital have been followed to death or for a period of time ranging from 21 to 84 months and averaging 49 months. Only 1 of the 25 survivors (Case 25, Table 2) was still in complete heart block when ready for discharge from hospital and indisputably required a permanent pacing system. Of the 24 who had returned to sinus rhythm only 2 had a normal PR interval and a normal QRS complex (Cases 1 and 2). In 5 patients there was both prolongation of the PR interval (more than 0.20 s) and of the QRS complex with partial bilateral bundle-branch block, indicating the possibility of return to complete heart block. In 2 of these patients (Cases 14 and 19) an attempt was made to install a permanent demand pacing system but, because endocardial potentials were considered too low, it was thought safer not to pace them; both

Table 1 Initial outcome in 52 patients with acute anterior myocardial infarction with complete heart block

Deaths in hospital	27
Myocardial failure	21
Ventricular fibrillation	4
Further infarction	1
Sudden death	1
Survivors	25
Atrioventricular block (paced)	1
Sinus rhythm (1 paced)	24

are still in sinus rhythm 47 and 49 months later. In a third patient (Case 20), with normal endocardial potentials, the continued use of procainamide for ectopic beats in the presence of partial bilateral bundle-branch block led us to install a demand pacing system, but despite this he died suddenly 18 months later. In 2 patients, complete heart block without syncopal attacks developed 4 months and 24 months later and pacemakers were inserted; 1 of these (Case 3) had had a long PR interval and a normal QRS and was well at 53 months, but the other (Case 5) who had had a long PR interval, left bundle-branch block, and heart failure, died suddenly at 3 years.

Thus, of the 16 patients alive and well at the end of the follow-up period, only 2 with complete heart block were being paced. The remainder were in sinus rhythm; 10 had partial bilateral bundle-

Table 2 Electrocardiographic findings after recovery from infarction and follow-up in the 25 survivors

Case No.	Age and sex	PR interval (s)	QRS	HV (s)	Follow-up period (mth)	Outcome
1	63 M	0.16	Normal	—	84	Sinus rhythm; alive
2	49 M	0.18	Normal	—	71	Sinus rhythm; alive
3	68 M	0.26	Normal	—	53	CHB; paced; alive
4	71 F	0.18	LBBB	—	3	Sinus rhythm; death
5	65 M	0.22	LBBB	—	36	CHB, paced; sudden death
6	57 M	0.28	LAH	—	43	Sinus rhythm; death
7	55 F	0.14	LAH	—	38	Sinus rhythm; sudden death
8	66 M	0.14	LPH	—	39	Sinus rhythm; alive
9	61 M	0.18	RBBB	—	55	Sinus rhythm; alive
10	65 M	0.16	RBBB + LAH	0.045	65	Sinus rhythm; alive
11	64 M	0.14	RBBB + LAH	0.040	13	Sinus rhythm; sudden death
12	48 M	0.16	RBBB + LAH	—	31	Sinus rhythm; alive
13	78 F	0.16	RBBB + LAH	—	36	Sinus rhythm; alive
14	59 M	0.21	RBBB + LAH	0.070	47	Sinus rhythm; alive
15	64 M	0.16	RBBB + LAH	—	62	Sinus rhythm; alive
16	61 F	0.12	RBBB + LAH	—	3	Sinus rhythm; death
17	47 M	0.20	RBBB + LAH	—	17	Sinus rhythm; death
18	69 M	0.20	RBBB + LAH	0.070	23	Sinus rhythm; alive
19	66 M	0.24	RBBB + LAH	0.070	49	Sinus rhythm; alive
20	71 M	0.24*	RBBB + LAH	0.065	18	Sinus rhythm; paced; sudden death
21	56 M	0.21	RBBB + LPH	0.065	55	Sinus rhythm; alive
22	60 M	0.16	RBBB + LPH	0.040	21	Sinus rhythm; alive
23	69 M	0.14	RBBB + LPH	—	41	Sinus rhythm; alive
24	36 M	0.22	RBBB + LPH	—	34	Sinus rhythm; sudden death
25	59 M	CHB*	LBBB	—	57	CHB; paced; alive

LBBB, left bundle-branch block; LAH, left anterior hemiblock; LPH, left posterior hemiblock; RBBB, right bundle-branch block; CHB, complete heart block.

*Patients paced before discharge from hospital.

branch block, and 3 of these also had a prolonged PR interval.

Of the 9 late deaths (Table 3), 4 were attributable to chronic irreversible heart failure or further infarction. The other 5 were sudden and might have been caused by ventricular standstill. Of the 5, 2 had pacemakers and normal *in vivo* function of the pacemaker had been confirmed in both patients within 2 months of death; furthermore, both the pacing electrode and pulse generator were satisfactory at necropsy. There were 3 patients who might have benefited from a pacemaker: 1 (Case 24) was in chronic heart failure, but in the 2 others a pacemaker might have been life-saving. Selection of these patients for prophylactic pacing would have presented difficulties since one (Case 7) was in sinus rhythm with unifascicular block, and the other (Case 11) was in steady sinus rhythm with a PR of 0.14 s and an HV of 0.04 s, though he did have right bundle-branch block with left axis deviation.

Discussion

The mortality of acute anterior infarction with complete atrioventricular block is reported to be approximately 80 per cent and results from the large size of an infarct, large enough to involve both right and left bundle-branch conducting systems (Stock, 1969; Norris *et al.*, 1972). The lower mortality (52%) in the group reported here may be the result of some selection of cases by their ability to survive transfer from another hospital. On the other hand, special precautions taken with the pacing technique probably played an important part, as these patients are particularly vulnerable to arrhythmias. Suppressant drugs were given before the electrode was passed through the tricuspid valve and a close watch was maintained for the low endo-

cardial potentials which are likely to occur in these patients with large infarcts and heart failure, and which may result in failure of inhibition of the demand pacing system, causing inappropriate stimulation with its danger of ventricular fibrillation (Chatterjee *et al.*, 1969). Thresholds were measured daily and the pacing voltage was kept to less than twice the threshold voltage. In some borderline cases overdrive fixed rate pacing was preferred to demand pacing. Demand pacing systems were not withdrawn until 7 days after return to sinus rhythm with the final 24 hours on a pacing counter to detect transient return of block. Despite these precautions, 4 patients died unexpectedly of ventricular fibrillation late in their hospital stay.

The long-term follow-up in this series confirms the high late mortality in survivors from complete heart block complicating anterior myocardial infarction. Sudden death, however, occurred in only 2 of the 14 non-paced patients with partial bilateral bundle-branch block, and our experience contrasts with that of Atkins and colleagues who reported sudden death within 6 months of hospital discharge in 5 of 6 unpaced patients who had partial bilateral bundle-branch block after anterior infarction with transient complete heart block (Atkins *et al.*, 1973). It is interesting to note that the same authors also reported a group of 12 patients in sinus rhythm with right bundle-branch block and left anterior hemiblock who were permanently paced; 6 died (2 suddenly) within 15 months (Ritter *et al.*, 1975).

A review of the published reports shows that the persistence of conduction defects after acute myocardial infarction is not a reliable guide to the risk of late sudden death. In the Coronary Drug Project, 13 patients with partial bilateral bundle-branch block after myocardial infarction were followed for

Table 3 *Electrocardiographic findings in 9 patients dying after discharge from hospital*

Case No.	PR interval	Type of conduction abnormality	Interval between infarct and death (mth)	Other features
<i>Sudden death</i>				
5	0.22	LBBB→CHB Permanent pacing	36	Dizziness + heart failure before pacing
7	0.14	LAH	38	Symptom free
11	0.14	RBBB + LAH (HV 40 ms)	13	Symptom free
20	0.24	RBBB + LAH (HV 65 ms) Antiarrhythmic therapy Permanent pacing	18	Necropsy showed fresh occlusion of right coronary artery
24	0.22	RBBB + LPH	34	Heart failure
<i>Further infarct</i>				
16	0.12	RBBB + LAH	3	
<i>Heart failure</i>				
4	0.18	LBBB	3	
6	0.28	LAH	43	
17	0.20	RBBB + LAH	17	

a period of 3 years without mortality (Coronary Drug Project Research Group, 1972). Nimetz *et al.* (1973) reviewed a group of 71 patients with right or left bundle-branch block complicating acute myocardial infarction and found that the presence or absence of atrioventricular block failed to distinguish candidates for late sudden death: in 30 patients with associated second or third degree atrioventricular block there were 18 hospital and 3 late (2 sudden) deaths; by contrast, in the 41 patients without atrioventricular block there were 5 hospital and 14 late deaths (8 sudden) (Nimetz *et al.*, 1973). More recently, Rosen and his colleagues recorded intracardiac electrocardiograms in a large but heterogeneous group of patients with right bundle-branch block and left anterior hemiblock and found no significant difference in the incidence of sudden death between those with prolongation of the HV interval and those in whom this measurement was normal (Denes *et al.*, 1975).

The mechanism of sudden death in such cases remains speculative. It has been implied that patients with partial bilateral bundle-branch block are at risk from death as a result of complete heart block and asystole. Such patients, however, have advanced coronary artery disease and sudden death may well be the result of ventricular fibrillation during an ischaemic attack. Watanabe has reported a high incidence of ventricular arrhythmias in patients with intraventricular conduction defects (Watanabe *et al.*, 1973). Hasanain *et al.* (1973) have reported that the majority of patients with bifascicular block have premature ventricular beats and occasional ventricular tachycardia when exercised on the treadmill. The fact that sudden death occurred in 2 of the 4 patients with permanent pacing systems in our series indicates the potential risk of ventricular fibrillation, possibly as a result of inappropriate stimulation by the pacemaker during acute myocardial ischaemia or infarction.

In conclusion, a high early and late mortality is to be expected after anterior infarction complicated by complete heart block because of the extent of coronary disease likely to be present and the large area of myocardial damage. It is doubtful, however, whether the overall late mortality is significantly different from that in any group of patients with severe coronary artery disease. It is, therefore, extremely difficult to judge the part played by irreversible damage to conducting tissue. From the evidence available we conclude that there is no

justification at present for the routine insertion of a prophylactic pacing system in patients, otherwise asymptomatic, who have returned to reliable sinus rhythm after anterior myocardial infarction with complete heart block, even in those with persisting partial bilateral bundle-branch block.

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