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Survival in second degree atrioventricular block

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SUMMARY Two hundred and 14 patients with chronic second degree heart block were seen and followed up in the Devon Heart Block and Bradycardia Survey between 1968 and 1982. The patients were divided into three groups according to the type of block. In group 1 there were 77 patients with Mobitz type I block (mean age 69 years), in group 2, 86 patients with Mobitz type II block (mean age 74 years), and in group 3, 51 with 2:1 or 3:1 block (mean age 75 years). The five year survival was similar in all groups, being 57%, 61%, and 53% in groups 1, 2, and 3 respectively. The presence or absence of bundle branch block did not appear to influence prognosis. In particular, patients in group 1 without bundle branch block did not fare any better than those in group 2 both with and without bundle branch block. One hundred and three of the patients were fitted with pacemakers, the proportion being greatest in group 2. In each group a significantly larger number of paced patients survived than unpaced. The five year survival for all the paced patients in the study was 78% compared with 41% for the unpaced. Since the paced patients were slightly younger than the unpaced two age matched groups of 74 patients each were selected from the paced and unpaced patients, but the five year survival of those paced was still significantly better.

It is concluded that in the patients in the present study chronic Mobitz type I block has a similar prognosis to that of Mobitz type II block. Unpaced patients with both types did very badly, whereas those fitted with pacemakers had a five year survival similar to that expected for the normal population. These results refute the benign reputation of chronic Mobitz type I block and imply that patients with this condition should be considered for pacemaker implantation on similar criteria to those adopted for patients with higher degrees of block.

The use of pacemakers has been a major advance in the treatment of different forms of bradycardia, and because of its dramatic effect in some groups of patients it has become the vogue. The reaction to this is the current reassessment of the place of the pacemaker in several conditions. Four years ago we produced evidence that the prognosis in chronic sinoatrial disorder (sick sinus syndrome) was not appreciably improved by pacing,[1] and recently the place of this form of treatment in high risk bundle branch block has been questioned.[2–4] Second degree Mobitz type I (atrioventricular nodal) block is widely believed to be relatively benign.[5–7] The corollary is that patients with this type of conduction disturbance do not require pacing in the absence of troublesome symptoms.[8–10] Nevertheless, the number of patients with second degree block in these studies is relatively small; furthermore, the reports come from highly specialised units, which in turn implies considerable case selection. Reappraisal of the natural history and indications for a pacemaker in partial heart block would now seem appropriate.

We report a 14 year prospective study to compare the outlook of patients with second degree Mobitz type I (atrioventricular nodal) block with that of those with Mobitz type II (distal) block, both with and without pacemakers. Recently, it has been suggested that 2:1 and 3:1 atrioventricular block may be a distinct form of second degree block.[5] Patients whose electrocardiograms consistently showed this pattern have been treated as a separate group.

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Patients and methods

ELECTROCARDIOGRAPHIC DIAGNOSIS

Patients with second degree block were sought from

Table 1 *Basic data on entry. Figures are numbers of patients unless stated otherwise*

	Patient groups			*All patients*
	1	*2*	*3*	
No in group	77	86	51	214
Mean age (yr)	69	74	75	72
Median age (yr)	72	74	77	74
Age range (yr)	25–96	44–92	31–97	25–97
Right bundle branch block	14	17	12	43
Left bundle branch block	13	19	6	38
Stokes-Adams attacks	25	40	19	84
Dizziness (short of loss of consciousness)	10	11	10	31
Chest pain on effort	18	17	9	44
"Cardiac" breathlessness	19	20	16	55
No major symptoms	35	30	16	81
Cardiac failure	4	6	6	16
Myocardial infarction	12	8	11	31
Sinus node disease	5	2	0	7
Congenital heart disease	2	2	0	4
Rheumatic fever	9	7	5	21
Diabetes	5	2	3	10
Cerebrovascular accident	9	6	5	20
Rheumatoid arthritis	10	9	5	24

the Devon Heart Block and Bradycardia Survey during the period 1968–82. This recruits by direct approach to the general practitioners in the area, from the open electrocardiographic service of the Exeter district, and from referrals to the cardiac department in Exeter by physicians of the Torbay, North Devon, and Exeter districts.[11 12] Patients with second or third degree block or unexplained bradycardia (ventricular rate below 56 beats/min) are admitted to the survey. Instances of transient block persisting for less than 28 days after acute myocardial infarction or carditis and drug induced block—in patients taking digitalis, block not persisting for more than 17 digitalis free days—are excluded.

Two hundred and fourteen of the patients seen in the survey were found to have second degree atrioventricular block on the standard 12 lead electrocardiogram, and these form the basis of the present study. Patients were divided into three groups according to the first electrocardiogram showing second degree block. Those with Mobitz type I or Mobitz type II block[13] formed groups 1 and 2 respectively. If the initial electrocardiogram showed 2:1 or 3:1 atrioventricular block but subsequent traces showed features of Mobitz type I or Mobitz type II the patient was allocated to the appropriate group. In some patients 2:1 or 3:1 block remained "fixed" and these formed group 3.

CLINICAL DETAILS

Table 1 shows the composition of the three groups. The mean and median age were lowest in group 1, although the differences from the other groups were not significant. There was a general preponderance of males, the sex ratio being 1·3 : 1 (males to females). Group 3 was unusual in having a gross reversal of the sex ratio of 0·65 : 1, the difference being significant at the 1% level. The figures for symptoms in Table 1 refer to those recorded by us on entry to the study. The complaint of breathlessness was considered to be cardiac in origin if the patient was receiving a daily dose of ≥40 mg frusemide or ≥1 mg bumetanide.

Table 2 *Numbers of patients showing a change in conduction during the survey*

Group	*BBB*		*Mobitz type I*		*Mobitz type II*		*Fixed 2:1 or 3:1 block*		*Third degree block*	
	On entry	*Later*	*On entry*	*Later*	*On entry*	*Later*	*On entry*	*Later*	*On entry*	*Later*
					Group 1					
No BBB	47		45	2	0	3	2	1	0	18
BBB	27	3	30	0	0	1	0	0	0	12
					Group 2					
No BBB	41		0	1	38	3	3	2	0	17
BBB	36	9	0	0	40	5	5	1	0	15
					Group 3					
No BBB	28		0	0	0	0	28	0	0	14
BBB	18	5	0	0	0	0	23	0	0	7

BBB, bundle branch block.

Symptomatic patients usually had more than one complaint, but 81 had no major cardiac symptoms on entry.

The reason for the patients' initial attendance to their doctor was not included in the data recorded when the survey started in 1968 and was added to the questionnaire subsequently. In the 131 patients seen during this latter period dizziness or some other disturbance of consciousness was the principal complaint in 54 patients (16 in group 1, 21 in group 2, and 17 in group 3) and coincidental non-cardiac illness was the next most common form of presentation in 29 patients (11 in group 1, 14 in group 2, and four in group 3). Other reasons for the patients seeking medical advice were breathlessness in 23, chest pain in six, routine medical examination in six, palpitation in three, and the reason for consultation could not be ascertained in 10.

SURVIVAL ANALYSIS

Survival was calculated from the date of the first observation of second degree block to the date of the last follow up examination or death, and the date of pacemaker insertion, if any, was noted. In the case of paced patients two sets of figures were derived, one dating survival from entry to the study and the other from the time of implantation.[1] In the absence of complications patients were reviewed annually with a questionnaire, physical examination, and an electrocardiogram. Every effort was made to follow patients leaving the district, but one of them, having been seen regularly for four years, was lost. Survival was analysed by the life table method.[14] Survival curves were compared year by year over a five year period using the Lee-Desu statistic,[15 16] and mortality figures for a normal population of the same age and sex distribution were calculated from the Registrar General Decennial Supplement.[17]

Results

CHANGES IN CONDUCTION

Few patients (five) changed from Mobitz type I to Mobitz type II, or vice versa, during the study and only 14 patients in groups 1 and 2 had episodes of 2:1 or 3:1 block (Table 2). Improvement in conduction to first degree block or normal conduction occurred in 35 cases. In 83 patients there was transient or persistent deterioration to third degree block. Bundle branch block was present in 98 patients, usually on entry, but in 17 it developed during the study.

Twenty patients developed Stokes-Adams attacks after entry to the study (seven each in groups 1 and 2 and six in group 3), and other major cardiac symptoms occurred in a further six patients. One hundred and three patients were fitted with pacemakers, the numbers in the groups being 33, 49, and 21 in groups 1, 2, and 3 respectively. Most patients were paced to prevent disturbance of consciousness, and this or another major cardiac symptom was present in 29, 41, and 18 of the paced patients in groups 1, 2, and 3 respectively. Three patients were paced to allow them to drive a car and 12 because of minor symptoms.

SURVIVAL DATA

The overall survival of patients in all groups was essentially similar (Table 3; Figure and Table 4), the median being 69 months. Paced patients fared considerably better than those unpaced in all groups. In group 1 the percentage survival at five years was 78 for paced subjects (dating survival from entry to the study) compared with 42 for unpaced subjects ($p<0.01$), in group 2 the figures were 73 and 48 respectively ($p<0.015$), and in group 3 they were 86 and 31 respectively ($p<0.001$). Table 3 also compares the survival of paced and unpaced patients pooling the data from groups 1, 2, and 3. The paced patients had a very much better outlook, but the two sets were not identical in respect of age since more of the younger patients were paced than the older patients (mean age difference 5 years). To reduce the age imbalance the paced and unpaced groups were both stratified by age, and randomised deletions were made so as to equalise the numbers of paced and unpaced patients within each age band. This process produced paced and unpaced subsets, each having 74 members. Age matching improved the five year survival of the unpaced patients from 41% to 49%. Nevertheless,

Table 3 *Percentage survival in the three groups for paced and unpaced patients. Values are mean (SEM)*

Group	*Survival at three years*				*Survival at five years*				*Significance (p)*	
	All patients	*Unpaced*	*Paced**	*Paced†*	*All patients*	*Unpaced*	*Paced**	*Paced†*	*Paced* vs unpaced*	*Paced† vs unpaced*
1	63·6 (5·8)	50·6 (7·9)	83·0 (6·9)	82·7 (7·1)	56·5 (6·2)	41·9 (8·0)	78·4 (7·9)	78·1 (8·0)	<0·01	<0·013
2	69·7 (5·5)	59·5 (8·7)	77·8 (6·6)	74·3 (7·1)	61·4 (6·2)	47·6 (9·3)	73·3 (7·6)	74·3 (7·1)	<0·015	<0·05
3	65·1 (7·3)	45·7 (9·9)	94·2 (5·7)	92·8 (8·2)	52·6 (8·2)	30·5 (9·8)	85·6 (9·7)	87·5 (13·7)	<0·001	<0·002
Pooled data	66·3 (3·5)	48·8 (5·1)	82·8 (4·1)	79·8 (4·4)	57·5 (3·9)	41·0 (5·2)	77·5 (4·8)	74·0 (5·2)	<0·0001	<0·0001

*Survival calculated from the date of entry into the study.
†Survival calculated from the date paced.

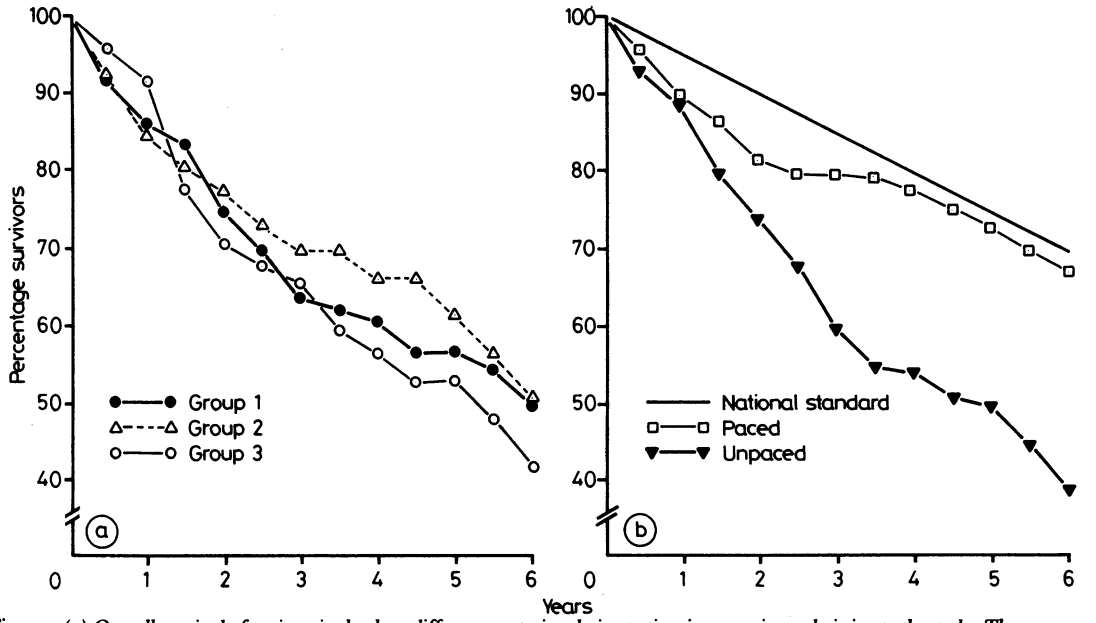

Figure *(a) Overall survival of patients in the three different groups in relation to time in years since admission to the study. The curves are taken to six years to show that there are no sudden changes in the trends after the initial five years. (b) Survival of paced patients compared with that of unpaced patients. In both cases the time in years was estimated from the date of entry to the study. An additional line is plotted which represents the expected survival for the general population (National Standard) of similar age and sex.*

they remained significantly worse off ($p<0.015$) than the paced patients, in whom the five year survivals were 72% when dated from admission to the study and 67% when dated from the time of pacemaker implantation. The Figure shows the survival data in the age matched paced and unpaced patients. A further curve is shown which represents the expected survival of a group of normal subjects of similar age and sex (National Standard) to the patients in this study. This line closely approximates that for the paced patients.

Table 4 *Percentage survival data for the three groups of patients illustrated in Fig. 1. The effective sample sizes are given in brackets at annual intervals*

Time intervals (mnth)	*Group 1*	*Group 2*	*Group 3*	*Pooled data*
0	100·0 (77)	100·0 (86)	100·0 (51)	100·0 (214)
3	93·2	93·8	100·0	95·0
6	91·8	92·5	95·6	93·0
9	90·4	87·2	91·1	89·3
12	86·2 (64)	84·5 (66)	91·1 (41)	86·7 (171)
15	83·3	83·2	82·0	83·0
18	83·3	80·4	77·3	80·8
21	78·9	78·9	70·2	76·9
24	74·4 (53)	77·5 (55)	70·2 (29)	74·6 (137)
27	72·9	77·5	70·2	74·1
30	69·9	73·0	67·7	70·6
33	65·2	71·4	67·7	68·2
36	63·6 (42)	69·7 (44)	65·1 (26)	66·3 (112)
39	62·0	69·7	65·1	65·7
42	62·0	69·7	59·2	64·3
45	60·3	67·9	56·1	62·3
48	60·3 (35)	66·0 (36)	56·1 (18)	61·5 (89)
51	56·5	66·0	52·6	59·3
54	56·5	66·0	52·6	59·3
57	56·5	63·8	52·6	58·4
60	56·5 (27)	61·4 (28)	52·6 (13)	57·5 (68)
63	56·5	56·3	52·6	55·6
66	54·2	56·3	47·8	53·7
69	49·6	50·5	47·8	49·6
72	49·6 (21)	50·5 (16)	42·8 (10)	48·6 (47)

Degree of block—Patients showing a change in degree of block, either towards improved conduction or to complete block, did not fare worse than those whose degree of block remained stable. Bundle branch block was not associated with any major difference in survival. The survival of all patients with and without bundle branch block was 62% and 70% at three years and 58% and 56% at five years. There were no important differences between patients with and without bundle branch block in the three groups. In particular, the three and five year survivals of the 47 patients in group 1 without bundle branch block (72% and 60% respectively) were similar to those of the patients in group 2 (70% and 61% respectively).

Risk factors—The potential risk factors of myocardial infarction and cardiac failure were not associated with significant differences in survival, but the numbers of patients with these conditions were small. In the non-paced patients there was a significant difference in survival ($p<0.01$) between those with Stokes-Adams attacks and those without, being 31% and 65% at three years and 25% and 51% at five years. The majority of patients with attacks were, however, paced, whereas those without were usually not paced, so that the overall effect of Stokes-Adams attacks on prognosis was reduced (the three and five year survival of those with attacks being 59% and 53% and those without being 73% and 62% respectively). There was no significant difference between the survival of patients with and without major cardiac symptoms, being 65% and 68% at three years and 58% and 56% at five years, but again there was a difference in the proportion of paced patients.

Pacing—Patients without major cardiac symptoms had a poor prognosis when left unpaced, with an overall three and five year survival of 59% and 45% respectively. There were some variations in the chances of survival in the three groups, but in all of them patients without major symptoms fared badly if they were not paced. In groups 1 and 2 the five year survivals were 48% and 49% respectively, and the mean ages of the unpaced patients without major symptoms were similar to that of the parent groups, being 67 and 75 years respectively. Unpaced patients without major symptoms in group 3 were rather older than the mean age for the group as a whole, the mean age being 80 years, and there was insufficient data to calculate survival at five years but the three year survival was only 29%.

Discussion

In 1968 Langendorf and Pick made a plea for the clinical distinction between type I and type II atrioventricular block on the routine electrocardiogram.[18] They considered this to be of particular value in the immediate postmyocardial infarction period, because they found that the prognosis of type I was much better than that of type II. With the introduction of the technique of His bundle electrocardiography several workers pointed out the potential fallibility in the use of the surface electrocardiogram to locate the site of block.[19-21] Nevertheless, classification on the basis of the surface electrocardiogram still appears to be generally acceptable. Goldreyer comments, "fortunately His bundle electrocardiography has shown that the location of the block is generally apparent from the electrocardiogram . . . . .",[22] and in 1979 Zipes wrote, "although the classification is descriptive, clinically separating second degree AV block into type I and type II serves a useful function and in most instances the differentiation can be made easily and reliably from the surface ECG."[6]

The similarity in outlook between patients with Mobitz type I and Mobitz type II second degree atrioventricular block in our study is at variance with current opinion.[10] Even patients with Mobitz type I block without bundle branch block, who previously were considered to have an optimum prognosis,[6] had a five year survival that was no better than that of patients with Mobitz type II block. Contrary to views expressed in published reports,[23] Stokes-Adams attacks were common in patients with Mobitz type I block in this series. Before discarding these results as a statistical quirk, we propose to review the evidence on which the present consensus is based.

In their report the American College of Cardiology and Heart Association Task Force on assessment of cardiovascular procedures concluded that Mobitz type I second degree atrioventricular block, when due to nodal delay, was relatively benign[24] and refer to three authoritative studies.[5 7 8] Donoso *et al* reviewed 11 patients with second degree block discovered in 100 consecutive cases of Stokes-Adams syndrome.[5] There were three patients with Mobitz type II block, one of whom died a year after initial assessment and another required a pacemaker. The other eight cases were of "more advanced atrioventricular block," varying between 3:1 and 5:1. Two of these patients died in hospital, and three more died in the next 12 months. They do not describe any patients with Mobitz type I block. Dhingra *et al* reported 15 patients with second degree atrioventricular block and bundle branch block, four of whom had Mobitz type I block.[8] They concluded that the clinical course in most of such patients would be "malignant," with most needing pacemakers whether the block was proximal or distal to the His bundle, and three of their patients with Mobitz type I block required pacemaker therapy. Strasberg *et al* reported 56 patients with chronic second degree atrioventricular block, fol-

Table 5 *Second degree atrioventricular block recorded by ambulatory electrocardiographic monitoring in studies of normal subjects*

Author	Subjects		Mobitz type I	Mobitz type II
	No	Age (yr)		
Scott *et al*[31]	131	10–13 (range)	14	0
Viitasalo *et al*[32]	35	23·0 (5·8) (mean (SD))	2	0
Brodsky *et al*[33]	50	23–27 (range)	3	0
Sobotka *et al*[34]	50	22–28 (range)	2	0
Clarke *et al*[35]	86	16–65 (range)	2*	1*
Clee *et al*[36]	50	Over 50	1	1
Camm *et al*[37]	98	Over 75	0	0

*One subject common to both.

lowed up for periods of between 157 and 2280 days.[7] They differentiated between those with and those without associated organic heart disease and found the latter to have a relatively benign cause. Nevertheless, this was a small group of only 19 patients, of whom seven were trained athletes and 12 were under 35 years old. Even in this rather unusual group six had had one or more syncopal attack, two were fitted with pacemakers during the study, and two died "non suddenly." Most of their patients (37) had organic heart disease, 16 of whom died during the study (10 were paced and five of these died during follow up). The reports sited above show the potentially dangerous nature of Mobitz type II second degree block, but the evidence that chronic Mobitz type I block is relatively harmless is far from definite.

Recent studies imply that the pathological distinction between Mobitz type I and Mobitz type II block if often blurred. Certainly, anatomical lesions in the conducting system show poor correlation with the electrocardiogram,[25 26] and this is not always greatly improved when the His bundle electrocardiogram is used to locate the block.[27] Ohkawa *et al* reviewed the histology of the conducting system in five patients with narrow QRS complexes and block proximal to the His bundle deflection (AH block) and four patients with wide QRS complexes and block distal to the His bundle deflection (HV block).[28] In the former, the main pathological change was found in the branching portion of the bundle in three of the five patients. The authors conclude that AH block resulted not only from lesions in the upper part of the His bundle but also from lesions in the branching portion.

Surveys of normal subjects, using standard electrocardiography, indicate that second degree atrioventricular block is very rare,[29 30] but Mobitz type I block has been recorded on ambulant electrocardiograms in some normal people. The conduction disturbance is transitory, usually occurring at night, and is principally seen in young subjects (Table 5). This phenomenon, commonly ascribed to excessive vagal tone, is unlikely to be confused with the persistent second degree block occurring in the elderly patients of the present study, although, possibly, it may have played a part in some of the young athletes studied by Strasberg *et al*.[7] The current study specifically excluded instances of transient Mobitz type I block, resulting either from digitalis toxicity or acute myocardial infarction, which may have a better prognosis than that of chronic idiopathic atrioventricular block. The natural history of chronic heart block is multifactorial,[38] and it is possible that a subset of patients with the features of Mobitz type I second degree block on the standard electrocardiogram have a good prognosis. No such group could, however, be identified in the present study, and analysis of the potential risk factors did not indicate any method of detecting low risk subjects.

Patients in group 3 with fixed 2:1 and 3:1 atrioventricular block fared similarly to those in the other groups. The site of block in this group has traditionally been considered to be in the bundle branches,[39] a view supported recently by His bundle electrocardiograms.[8] The one major difference between group 3 and the rest was the considerable predominance of women in group 3. Men exceed women in most published studies of heart block, but Kulbertus *et al* found women to predominate in one subgroup of interventricular block.[40]

We conclude that a review of three key references does not present convincing evidence of a good risk group of patients with Mobitz type I second degree block. The main objectives for pacemaker therapy, in heart block, are to improve the chances of survival and prevent troublesome symptoms, in particular Stokes-Adams attacks. In all three groups in the present study, paced patients lived longer than unpaced, the difference being significant both in Mobitz type I and Mobitz type II block. Even patients without major symptoms fared badly if left unpaced. Inevitably, since this was not a randomised controlled trial of pacing, the paced and unpaced patients were not comparable in all respects. Nevertheless, no major risk factor appeared to predominate in the unpaced patients at the expense of the paced. Stokes-Adams

attacks occurred in almost half of the patients in each of the three groups studied. Current advice is that, in the absence of special circumstances, patients with chronic Mobitz type II second degree block should be treated with pacemakers. This study implies that a similar approach should be adopted in cases of chronic Mobitz type I second degree block.

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