PROGNOSIS OF RIGHT BUNDLE BRANCH BLOCK : A STUDY OF 104 CASES*

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Prompted by the clinical impression that patients with right bundle branch block have a better prognosis than do those with cardiographic evidence of a left bundle lesion, a study of a group of cases with the former disorder has been prepared with particular reference to the survival time following diagnosis.

The first description of the electrocardiographic manifestations of bundle branch interruption in 1910 by Eppinger and Rothberger and later by Lewis in 1916 was followed by a period of classification. The criteria of Carter (1914) were rightfully questioned by numerous observers (Oppenheimer and Rothschild, 1917; Oppenheimer and Pardee, 1920; Fahr, 1920; & Mann, 1920), until Barker, Macleod, and Alexander (1930) presented substantial proof (supported later with Wilson, 1932) that the common type of bundle branch block was left, and not right as was formerly thought; and that the unusual type of block was in reality due to a defect in the right bundle branch. In 1934 Bayley divided the curves of right bundle branch block into four clearly differentiated groups.

In recent years it has been suggested that a deviation of the electrical axis plays a role in the formation of the characteristic curves of bundle branch block (Prinzmetal, Oppenheimer, and Dack, 1937), and that the type of block may depend on which ventricle is predominantly enlarged (Master, Kalter, Dack, and Jaffe, 1940). Even the careful review and histopathological analysis of Yater (1938) leaves doubt as to exact clinical correlations. One is forced to admit that the diagnosis of right or left bundle branch block is purely electrocardiographic, cannot be foretold by examination of the patient, and cannot always be determined by microscopic section. Furthermore, the exact mechanism whereby these curves are produced is not completely understood.

OUR MATERIAL AND RESULTS

One hundred and four cases of right bundle branch block were selected from private records and from the house and out-patient departments of the Peter Bent Brigham Hospital (60 and 44 cases respectively) on the basis of their

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fulfilment of electrocardiographic criteria of diagnosis. Cases of bundle branch block with short P-R interval (Wolfe-Parkinson-White syndrome), which have a good prognosis, were excluded. Serological data were available in about one half the group, and on the charts of three-quarters specific answers were given to questions concerning a previous history of rheumatic fever or its manifestations. Follow-up information was secured in some instances by letters from either the patient or his family physician, and in the remainder by our own examination.

All cases with a QRS interval of 0.12 sec. or over and a conspicuous S wave in lead I (Wilson, Johnston, Hill, and Macleod, 1934; & Wilson, Johnston, and Barker, 1934) were selected; all others were discarded. Although the T waves were upright in lead I and inverted in lead III in all but 4 instances, and increased amplitude of the QRS deflections was present in all but 6 cases, these were not used as diagnostic criteria.

Sex and Age.—The average age of the 104 patients was 56 years. Of these, 75 were male and 29 were female. The men averaged 55 and the women 58 years of age. The age and sex distribution are illustrated in Fig. 1. It is

FIG. 1.—Age distribution of 104 cases of right bundle branch block when the diagnosis was first made, males and females.

of some interest that the youngest was 5 years old, and that there were four under 20 years of age.

Antecedent Cardiac Symptoms.—Before the diagnosis of right bundle branch block by electrocardiogram, 9 patients denied any symptoms or signs referable to the heart; in fact the condition in these cases was entirely symptomless. The average duration of antecedent symptoms in the entire group was two years and nine months. Of those with cardiac manifestations (95 of the 104 cases) major complaints were as follows: 53 had dyspnoea; 39, angina

pectoris; 15, præcordial (but not anginal) pain; 12, palpitation; 10, syncopal attacks; and 8, a history of dizziness. As the presenting complaint, angina pectoris was the chief difficulty in 30, dyspnoea in 27 cases.

Congestive Failure.—On examination at the time of diagnosis, 77 patients showed no signs of right- or left-sided cardiac insufficiency, 14 showed slight evidence of failure, 12 moderate evidence, and only 1 severe congestive failure. The comparative benignity of right bundle branch block becomes evident from these figures.

Cardiac Enlargement.—32 had a slight increase and 18 showed enlargement well beyond the left mid-clavicular line. In 9 the cardiac borders could not be determined. There was no enlargement of the cardiac area by percussion in 40. In 11 of the 24 patients, who had teleo-radiograms taken, an increase in the size of the heart was apparent.

Blood Pressure.—The following figures exclude the determinations obtained in the 3 patients who were *in extremis* when first seen. The average blood pressure of 101 patients was 155 mm. systolic, and 88 mm. diastolic. 59 patients had systolic pressures over 140; these ranged up to 240 mm., the average being 178 mm.; the diastolic readings were nearly all greater than 90 mm., and ranged from "0" to 165 mm., the average being 96 mm. Of these hypertensive cases, 38 (64 per cent) were males, the remaining 21 (36 per cent) being females. 42 patients had systolic readings of from 100 to 140 mm., the corresponding diastolic pressures being from 60 to 90 mm. Of these cases, 36 (86 per cent) were males, while the remaining 6 (14 per cent) were females. It is apparent that the blood pressure in these cases may vary from low to extremely high levels, though on the average it is slightly elevated.

Auscultation of the Heart.—Reduplicated heart sounds, gallop rhythm, and pulsus alternans are often regarded as bearing some relationship to bundle branch block. It is of interest that gallop rhythm was noted in but 10 instances, reduplicated sounds heard in 6, and pulsus alternans present in but 5. Except in one instance, all patients having a protodiastolic gallop or alternating pulse showed signs of advanced cardiac disease and death occurred within two years. A specific notation as to the presence or absence of these signs was made in 80 per cent of the series. The most common auscultatory abnormalities were an apical systolic murmur (24 patients) and distant heart sounds (20 patients).

QRS Interval.—68 cases had a QRS interval of 0.12 sec., 18 of 0.13 sec., 14 of 0.14 sec., 3 of 0.15 sec., and 1 case an interval of 0.16 sec.

All of the patients with right bundle branch block in this series fitted into one of the four groups described by Bayley in 1934 (Fig. 2). This investigator classified 70 cases with right-sided bundle branch lesions, and found that 20 per cent were in group I, 33 per cent in group II, 40 per cent in group III, and 7 per cent in group IV. Our findings were very similar with 23 per cent in the first group, 28 per cent in the second, 45 per cent in the third, and 4 per cent in the fourth category.

Associated Electrocardiographic Abnormalities.—As regards disorders of rhythm, premature ventricular beats were demonstrated in 8 cases, premature

FIG. 2.—Four types of electrocardiograms indicating right bundle branch block, according to Bayley classification.

auricular contractions in 4, auricular fibrillation in 4, and sinus pauses in 2. Conduction disorders were found in 9 patients: delayed auriculo-ventricular conduction in 4, incomplete A-V block with dropped beats in 3, and intermittent complete block in 2. Low voltage was recorded in 6 cases.

Other changes appeared only in subsequent electrocardiograms. Two patients developed auricular fibrillation some time after the original diagnosis of bundle branch block, one partial block became complete, one with regular rhythm showed a complete block, and in one instance there was lengthening of the P-R interval.

Ætiology.—Hypertensive cardiovascular disease was the underlying cause in 48 patients. Degenerative heart disease was the cause in 40: it was diagnosed by the presence of cardiac signs or symptoms in the absence of hypertension, valvular disease, or other obvious cause. Rheumatic heart disease with damaged valves were the cause in 9, congenital defect in 2, and syphilitic aortitis with aortic insufficiency in 1 patient. In 4 patients no definite diagnosis was established: one was a young man without apparent illness, the second had gout, the third pneumonia, and the fourth had myxœdema.

A clinical diagnosis of myocardial infarction was made, either before or after the appearance of the bundle branch lesion in 10 patients. Other associated diagnoses included diabetes in 6, asthma in 3, and carotid sinus sensitivity in 2 patients. One of the hypertensive group had a toxic nodular goitre during the course of his illness.

Follow-Up.—Of the 104 in this series, 41 were capable—during the period of observation—of carrying out their normal activities without limitation because of cardiac symptoms. 13 patients were seen at the time of diagnosis only, and no subsequent data could be obtained. Of the 91 patients followed, 62 were living an average of four years and one month later, while 29 died within an average of three years. 29 patients were known to have died, 4 of cardiac failure, 3 of coronary occlusion, and 2 of cerebral hæmorrhage. 9 died of unrelated causes, and in 11 cases information as to cause of death was inadequate. A more detailed analysis is shown in Table I.*

* In the period during which this manuscript was being prepared for publication, Willius, Dry, and Reeser (1941, *Arch. intern. Med.*, 67, 1038, *ibid.*, 67, 1027, *ibid.*, 67, 1034) have in general confirmed these results.

TABLE I

THE PROGNOSIS OF PATIENTS WITH RIGHT BUNDLE BRANCH BLOCK

	PATIENTS ALIVE AT END OF					
	1 year.	2 years.	3 years.	4 years.	5 years.	10 years.
62 patients alive when last followed ..	52 (84%)	44 (71%)	33 (53%)	25 (40%)	19 (31%)	5 (8%)
29 patients known to have died ..	18 (62%)	15 (52%)	11 (38%)	9 (31%)	7 (24%)	1 (3%)
23 patients known to have died * ..	18 (77%)	15 (65%)	11 (48%)	9 (39%)	7 (30%)	1 (4%)
91 total followed patients	70 (77%)	59 (65%)	44 (48%)	34 (37%)	26 (29%)	6 (7%)

* This group omits 6 cases that died within a few days of first examination.

Six patients (21 per cent of the group followed until death) died within a few days of the original diagnosis. One patient, with angina pectoris, died of metastatic neoplasm sixteen years and seven months after the discovery of right bundle branch block, and another was known to be alive after seventeen years. Patients under 50 years of age lived an average of five years, while those aged 50 or over averaged just under three years.

PROGNOSIS

When one speaks of the prognosis of patients with bundle branch block, it must be realized that the lesion may have ante-dated its electrocardiographic demonstration by an indefinite period. Furthermore, it might be thought that the average survival time amongst the group still living, if followed to death, would be decidedly greater than that of the known fatal cases. This does not prove to be so in studies of prognosis when the number of cases analysed is sufficient; the main reason, of course, being that amongst the living cases there are some, who have only recently been observed for the first time and may yet die within a short period, to compensate for those already known to be alive for a great many years. In fact, Table I shows very little difference between the survival time of the fatal and non-fatal cases.

Attempts at comparison with other follow-up studies of bundle branch block show that diagnostic criteria were not always identical, presentation of analyses were not always similar, and in some series, electrocardiograms were taken routinely, while in others, only in suspected heart disease. In addition, as this disorder of conduction has only been known for a short period of time, early investigations included a smaller number of cases, shorter survival observations, and fewer cases followed until the fatal termination.

Early studies (Carter, 1914; Willius, 1919; Herrick and Smith, 1922;

Hart, 1925; Cowan and Bramwell, 1925; Talley and Reed, 1926; Bach, 1930; Campbell and Turkington, 1931; Graybiel and Sprague, 1933; & King, 1934) included cases with QRS intervals of 0.11 sec., often failed to separate right and left types or added indeterminate forms of bundle branch block. In almost all such series, consisting chiefly of cases of left-sided disorders, the majority of patients were dead six to fourteen months after diagnosis. Von Deesten and Dolganos (1934) were among the first to comment on the favourable prognosis of right bundle branch block (5 cases), and the 64 cases presented by Wood, Jeffers, and Wolferth (1935) did unusually well.

On the other hand, Sampson and Nagle (1936) reported that only 27 per cent of 109 cases of left bundle branch conduction defect that terminated fatally were dead in the first year and 42 per cent by the second year, although they included those with a QRS interval of 0.11 sec. Freund and Sokolov (1939), using adequate diagnostic criteria, claimed that the average length of life after discovery of the lesion was about the same (one year) in 58 fatal cases of left block as in 32 cases of right bundle branch block. Bishop and Carden (1939) found the average survival time of 29 cases that died was three years, but intermediate and a few right-sided lesions were included. Kaplan and Katz (1939), again without subdivision as to types, stated that 80 per cent of 75 known fatal cases died during the first year.

It is evident from the preceding that a great deal of variation exists in prognostic methods and results, but that only the left bundle branch block series of Sampson and Nagle (1936) and Bishop and Carden (1939) show longer survival periods than do the cases of right bundle branch block presented in this study. It is also true that other reports of right bundle branch block are not consistent, Wood and his associates (1935) differing widely from Freund and Sokolov (1939) in their respective studies. Yet it is unfair to place the majority of these follow-up series side by side because of difference in diagnostic criteria, admixtures of indeterminate types of block, and dissimilar methods of statistical analysis.

For this reason a group of 60 patients with left bundle branch block (with QRS interval of 0.12 sec. or over, and an upward deflection lead I without Q or S waves), followed until death, were selected for comparison. This series was prepared so that the ratio of private and hospital cases and the dates of the original diagnosis were similar to the 29 fatal cases reported above. The average age of this group was 59 years. The results (Fig. 3) show decidedly more favourable survival figures in patients with a right bundle branch conduction defect. The average time of death after diagnosis of the left bundle group was one year and two months, with 60 per cent of the cases dead by the end of the first year. The longest survival time in this fatal group was five years and eight months. One patient not included in this study, because he is still alive, is in fairly good health fifteen years after left bundle branch block was first discovered.

Fig. 3.—Comparison between the survival period of cases of left and right bundle branch block.

CONCLUSIONS

An analysis of 104 cases of right bundle branch block has been prepared.

It was observed that reduplicated heart sounds, gallop rhythm, and pulsus alternans were uncommon in this series. The two latter disorders were noted in a small group that had advanced heart disease.

Forty per cent of the patients had no appreciable subjective discomfort from the heart. In fact, some have no subjective or objective evidence of heart disease apart from the right bundle branch block.

The average survival time after the diagnosis of right bundle branch block of 29 fatal cases was three years. If the 6 cases that came into the hospital more or less moribund and died within a few days are excluded, the average survival period of the fatal group was four years and five months. Of the 62 patients alive when last seen or heard from, the average survival period was four years and one month. The longest survival period amongst the living cases was seventeen years, and amongst the fatal cases, sixteen years and seven months.

The clinical impression that patients with right bundle branch block have a distinctly more favourable prognosis than do those with a left bundle branch lesion has been sustained.

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