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On Block of Something Less Than a Bundle Branch, or of Something More

SPECIFIC and convincing data on the electrophysiologic consequences of block of a subdivision of the right or the left bundle branch have accumulated primarily during the past decade. As long ago as 1917, Rothberger and Winterberg described the electrocardiographic consequences of severing the right bundle branch plus the anteroseptal ramifications of the left branch. Grant, on the basis of theory and of pathologic evidence, asserted that clinical left-axis deviation was an expression of block to the spread of excitation through the anterior division of the left bundle branch. However, precise and consistent correlation of significant left-axis deviation (−30° or more) with specific myocardial lesions proved an elusive goal. Summated evidence lent support to the conclusion that when myocardial infarction and left axis deviation coexist, other electrocardiographic abnormalities more specific to infarction usually are present; and conversely, if left-axis deviation is the sole electrocardiographic abnormality, coexisting myocardial infarct is uncommon. Uncertainty persisted regarding the nature of the lesion responsible for left-axis deviation.

Elucidation of that relationship was sought in the experimental setting. Studies on canine hearts reported between 1962 and 1965 supported the thesis that left anterior septal lesions produced a shift to the left of mean electrical axis in the frontal plane. However, the degree of shift was less than commonly believed to be clinically significant. This limitation in evidence derived from dogs was removed by the results of studies in baboons and monkeys, and by observation of the electrocardiographic consequences of anteroseptal lacerations in patients subjected to surgical treatment for hypertrophic subaortic stenosis.

From this point on, experimentally derived data accumulated rapidly. If a lesion confined to the anterior fascicle of the left bundle branch could be produced and its electrocardiographic consequences identified, then production of a comparable lesion of the posterior fascicle of the left bundle branch and determination of the electrocardiographic effects was evidently feasible. Such proved the case, as did experimentally induced right bundle-branch block in combination with block of either anterior or posterior fascicles of the left bundle branch. Display, in the experimental setting, of the effects of varying degrees of incomplete block of either the right or left bundle branch on the form of ventricular complex was also accomplished.

The changes in ventricular excitation produced by destroying the subendocardial myocardium of the free wall of the left ventricle were defined and found consonant with the clinical concept of myocardial or postinfarction block. The summated electrocardiograms...
graphic changes of anterior fascicular block and myocardial block were reported, as were changes induced by other combinations of block involving both specialized conduction pathways and the myocardium.15

Advances in clinical understanding of fascicular block had not awaited accumulation of experimental data. Not only were the electrocardiographic changes postulated but the clinical implications were adduced. Of particular significance was the recognition that whereas the prognostic implications of uncomplicated left-axis deviation were unimpressive, combined block involving the right branch and either anterior or posterior fascicles of the left branch was of greater clinical consequence. Lasser, Haft, and Friedberg16 found that right bundle-branch block combined with abnormal left-axis deviation was the "...predominant conduction abnormality during orthograde (antegrade) conduction in patients who have experienced transient or permanent complete heart block (59% of a series of 44 patients)," and that: "The incidence of this pattern in 5,500 consecutive hospital records was 1%. Of these, 10% manifested complete heart block." Our own observations on clinical incidence of right bundle-branch block (RBBB) combined with left-axis deviation were supportive.17 Rosenbaum18 reported that 25 of 30 cases of right bundle-branch block with left posterior hemiblock had some form of atrioventricular (A-V) block. Adams-Stokes seizures were recorded in 18 patients (60%).

These significant advances in understanding of ventricular excitation are best applied with caution, for a number of reasons. For example, although the electrocardiogram of left anterior fascicular block, either alone or in combination with RBBB, can be recognized with comparative ease and precision, the same cannot be said for the consequences of left posterior fascicular block either isolated or combined with RBBB. The electrocardiographic diagnosis of the latter depends heavily on the presence of ventricular complexes characteristic of both blocked and unblocked type in a single record, or the accumulation of electrocardiograms made at different times, some showing complexes of blocked type and some, unblocked.

Further, the attraction of new knowledge should not obscure the wisdom of old teachings. Electrocardiographic evidence of aberrant ventricular excitation is a narrow base for clinical diagnosis or prognostication in the absence of supporting evidence of organic heart disease.

Substantial effort should be made to achieve a simple, uniform, descriptive, and accurate terminology for these several forms of intraventricular block. Four terms have been used more or less synonymously in recent years. "Arborization block" may define accurately the anatomic lesion or lesions, but its significance is confused by indiscriminate use of the term in clinical settings in years past. "Hemiblock" is an attractively concise and novel term which has caught on quickly, but implies a separation, into two halves, of the left bundle branch and left ventricular excitation not totally consistent with current knowledge. The terms "fascicular block" and "division block" both can be appropriately modified to permit accurate identification of such structural and functional relationships as present and future studies may justify. We favor "fascicular block" but suspect "hemiblock" will prevail.

One of the most intriguing problems in ventricular excitation has not yet been resolved, namely, to what degree do specific regions of the ventricular myocardium depend for their normal excitation on the functional integrity of specific fibers in the common bundle (His) or its major divisions? Conversely stated, to what extent do specific fibers in the common bundle proceed in relative functional isolation to a destination in specific segments of the ventricular myocardium? Functional isolation at septal level must surely be relative only, a conclusion suggested both by experimental data and by simple observation of the net-like structure of the septal subendocardial myocardium in both canine and primate hearts. At higher levels in the atrioventricular conduction system, within the
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substance of the common bundle, our own efforts\textsuperscript{19} to produce punctate lesions resulting in electrocardiographically identifiable changes in ventricular excitation have met with limited success. Few lesions of the common bundle evoked such changes and these lesions were confined to the branching portion of the bundle. Lesions at higher levels either evoked no change in ventricular excitation or produced varying degrees of atrioventricular block. We deduced that unless a group of fibers is destroyed at a point very near its emergence from the common bundle onto the upper left septum, bypass of the blocked fibers occurs with little if any aberration of excitation. This bypass may be postulated to occur either in the bundle at the level of the lesion or in the network of fibers on the left septal endocardium.

A decade’s accumulation of evidence, experimental and clinical, has provided an expanded base for interpretations of electrocardiographic expression of disturbed ventricular excitation and for correlations and prognostications derived from those interpretations. A satisfying advance in clinical competence attends mastery of these details, although that competence bears on but a small corner of a large field.

RAYMOND D. PRUITT
THOMAS B. WATT, JR.

References

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