The Risk of Cardiac Complications in Surgical Patients with Bifascicular Block*
A Clinical and Electrophysiologic Study in 98 Patients

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Ninety-eight patients with ECG evidence of bifascicular block who had undergone general anesthesia and surgery have been followed up. His bundle electrogram was recorded in all patients prior to the surgery. On the basis of electrophysiologic studies, patients were classified in two groups: normal H-V group (47 patients) and prolonged H-V group (51 patients). The prolonged H-V group presented a significantly greater incidence of organic heart disease and cardiac symptoms. Correspondingly, there was a significantly higher incidence of cardiac intra- and postoperative complications in patients with prolonged H-V interval, but none of the patients developed complete heart block. Ventricular fibrillation and not the occurrence of complete heart block, was the cause of sudden cardiac death in three patients who had a prolonged H-V interval and severe organic heart disease. Patients with bifascicular block, undergoing anesthesia and surgery, even in the presence of presumable risk factors, do not require prophylactic pacing. The H-V duration represents a more accurate predictor of major cardiac intra- and postoperative complications than the surface recordings, but only in patients with symptomatic heart disease. These data support the concept that high-risk patients can be identified clinically and thus preoperative determinations of H-V intervals should not be recommended.

In recent years there has been considerable interest in the possibility that a significant number of patients with chronic bifascicular block may develop complete heart block (CHB). However, a review of the literature reveals widely differing incidences of progression to CHB among these patients.1-4 The introduction of the His bundle electrogram (HBE) recording has provided a clinical method of studying the electrophysiologic mechanism of A-V conduction. Theoretically, patients with bifascicular block and prolonged H-V interval should be at risk for progression to CHB. Although recent prospective follow-up studies have demonstrated that patients with bifascicular block and prolonged H-V interval have a higher cardiac morbidity and mortality,5-15 the question of the value of the H-V interval in predicting the chances for CHB has not been entirely resolved.10 On the other hand, the precise factors responsible for precipitation of CHB in patients with bifascicular block are not known. The possibility that the stress of anesthesia and surgery may precipitate CHB leads to the question of how to manage patients with bifascicular block who present for elective major surgery.

It is the aim of this study to determine, from a group of patients with chronic bifascicular block, the incidence of intraoperative and postoperative complications, particularly the development of CHB, in response to anesthetic and surgical stress. The relationship of H-V interval to cardiac complications is also described.

MATERIAL AND METHODS

Ninety-eight patients with chronic bifascicular block who underwent major surgical procedures under general anesthesia during the period from January, 1972 to January, 1978 form the basis of this report. Of these patients, 48 showed right bundle branch block (RBBB) + left anterior hemiblock (LAH) (28 men and 20 women, mean age 72 years); 40 left bundle branch block (LBBB, mean age 69 years); and 10 RBBB + left posterior hemiblock (LPH) (5 men and 5 women, mean age 64 years). All definitions were based on the recommendations of the Criteria Committee of the New York Heart Association.16

RBBB: The criteria for diagnosis of RBBB included a QRS duration of 0.12 second or greater with rSR or with QR configuration of the QRS in lead V1. LAH: When the mean frontal QRS axis was more negative than −30°, LAH was diagnosed. LPH: Criteria for diagnosis of LPH with RBBB included a mean frontal QRS axis more positive than +110°.
and absence of right ventricular hypertrophy. LBBB: Diagnosis of LBBB included the following criteria: 1) QRS duration of 0.12 second or greater; 2) the presence of a broad monophasic R wave in lead V6; and 3) ST depression and T wave inversion in V6.

Patients who showed Mobitz type 2 A-V block or CHB while in the hospital or any ECG evidence of Mobitz type 2 block or CHB in the past were excluded. Each patient was carefully evaluated prior to the surgical procedure. Initial evaluation included history with special attention to syncopal attacks, physical examination, chest x-ray film and routine laboratory testing. A clinical diagnosis was established in each patient. Arteriosclerotic heart disease was diagnosed if the patient had a history of typical exertional angina, a previous diagnosis of definite myocardial infarction or a positive coronary arteriogram. Hypertensive heart disease was diagnosed if repeated blood pressure recordings indicated a systolic pressure greater than 150 mm Hg and diastolic pressure greater than 100 mm Hg. Patients with normal heart size on chest x-ray examination and without signs or symptoms of organic heart disease were diagnosed as having primary conduction disease. HBE was recorded, following informed consent by the patient, one or two days prior to surgery, using Scherlag’s method. One or more leads of the surface ECG were recorded simultaneously with the intracardiac electrogam on a multichannel electrocardiograph (Hewlett Packard 45685A), at a paper speed of 100 to 200 mm/sec. The following intervals were measured: A-H, a measure of A-V nodal conduction (normal 70-140 msec) and H-V, a measure of conduction time in the His-Purkinje system (normal 35-55 msec). H-V interval greater than 75 msec was considered markedly prolonged. In patients with a history of syncope, preoperatively a temporary prophylactic pacemaker was positioned in the apex of the right ventricle and left in position on demand. The rate of the temporary pacemaker was 40 per minute. Anesthetic premedication consisted of meperidine or diazepam and atropine. Anesthesia was induced with thiopental sodium or propanidide followed by succinylcholine or d-tubocurarine or pancuronium. Thereafter, anesthesia was maintained with various anesthetic drugs: halothane was used in 57 cases, methoxyflurane in 24, enflurane in 12, nitrous oxide only in 5. The length of anesthesia ranged from 25 minutes to 7 hours. Anatomic distribution of the sites of surgical procedures was: genitourinary tract 32, gastrointestinal tract 30, orthopedic 7, head and neck 4, gynecologic 12, breast 3. The ECGs of all patients were monitored continuously on an oscilloscope during surgery and the first postoperative day and then each patient was followed by serial ECGs until the seventh postoperative day. The monitoring was done by the anesthesiologist during surgery and in the recovery room, and by the nurses throughout the first postoperative day. The presence of any arrhythmia or triggering of the pacemaker was recorded. For data analysis, the 2 by 2 chi-square method with Yates correction for continuity was used.

RESULTS

Table 1 shows electrophysiologic findings in 98 patients with chronic bifascicular block. There was a significantly greater incidence of prolonged H-V intervals in patients with LBBB and with RBBB + LPH. On the basis of electrophysiologic studies, the 98 patients were classified into two groups: normal H-V group (47 patients) and prolonged H-V group

| Table 1—Electrophysiologic Data in 98 Patients with Bifascicular Block |
|-----------------------|-----------------------|-----------------------|
|                        | RBBB LAH (48 patients) | LBBB (40 patients) | RBBB LPH (10 patients) |
| ECG                    | no | %  | no | %  | no | %  |
| Normal A–H             | 38 | 79 | 28 | 70 | 7  | 70  |
| Prolonged A–H          | 10 | 21 | 12 | 30 | 3  | 30  |
| Normal H–V             | 34 | 71 | 11 | 27.5 | 2 | 20  |
| Prolonged H–V          | 14 | 29 | 29 | 72.5 | 8 | 80  |
| RBBB: right bundle branch block; LAH: left anterior hemiblock; LPH: left posterior hemiblock (51 patients). The clinical classification of heart diseases of the two groups of patients is presented in Table 2. The prolonged H-V group presented a significantly greater incidence of organic heart diseases. Cardiac symptoms, selected clinical findings, and cardiac drugs are presented in Table 3. There was a significantly higher incidence of myocardial dysfunction in patients with prolonged H-V interval. Most of the patients with a normal H-V interval were in NYHA functional class 1 or 2, whereas the majority of patients with a prolonged H-V interval were in classes 3 and 4. Correspondingly, there was a significantly higher incidence of patients who received cardiac drugs in the prolonged H-V group. Table 4 shows intraoperative and postoperative cardiac complications. There was a significantly greater incidence of cardiac complications in patients with prolonged H-V interval; however, none of the patients developed CHB and in no instance was pacemaker required intra- or postoperatively. Table 5 shows perioperative cardiac complications in patients with mild to moderate (50-75 msec) and marked (> 75 msec) H-V prolongation. There was a significantly higher incidence of cardiac complications in patients with marked H-V prolongation. Table 6 shows perioperative cardiac complications.

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<tr>
<th>Table 2—Classification of Heart Disease in 98 Patients with Normal and Prolonged H-V Interval</th>
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<tr>
<td>Normal H-V H-V (47 patients) (51 patients) no % no % P</td>
</tr>
<tr>
<td>Primary conduction disease</td>
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<tr>
<td>Organic heart diseases (total)</td>
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<tr>
<td>Arteriosclerotic</td>
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<tr>
<td>Hypertensive</td>
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<td>Primary myocardial</td>
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<tr>
<td>Valvular</td>
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<tr>
<td>Other</td>
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NS: not significant; P: probability
Cardiac symptoms and physical findings (total) 16 34 35 69 <0.005
Syncope 6 37.5 5 14
Angina 5 31 9 26
Previous myocardial infarction 4 25 11 31
Premature ventricular beats 5 31 24 69
Protodiastolic gallop 3 19 17 49
Congestive heart failure 6 37.5 19 54
Dyspnea 10 62.5 23 66

NYHA class
1-2 37 78 20 39 <0.0005
3-4 10 32 31 61 <0.001

Cardiac drugs (total) 13 28 29 7 0.01
Digitalis 11 85 26 90
Antiarrythmic drugs (quinidine, proprano-
lool, procainamide, ajmaline)

in symptomatic and asymptomatic patients with prolonged H-V interval. There was a significantly higher incidence of cardiac complications in patients

<table>
<thead>
<tr>
<th>Normal</th>
<th>Prolonged</th>
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<td>H-V (47 patients)</td>
<td>H-V (51 patients)</td>
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Table 4—Cardiac Intraoperative and Postoperative Complications in 98 Patients with Normal and Prolonged H-V Interval

Intraoperative complications (total) 18 38 33 65 <0.025
Hypotension 4 22 3 10
Sinus bradycardia and hypotension 4 22 4 12
Marked sinus bradycardia 4 22 4 12
Atrial tachyarrhythmias 2 11 7 21
Ventricular premature beats 4 22 12 36
Ventricular tachycardia — — 1 3
Ventricular fibrillation — — 1 3

Postoperative complications (total) 9 19 25 49 <0.005
Angina 2 22 5 20
Myocardial infarction — — 3 12
Premature ventricular beats 3 33 12 48
Atrial tachyarrhythmias 2 22 7 28
Ventricular fibrillation — — 3 12
Congestive heart failure 1 11 3 12
Acute pulmonary edema 1 11 2 8

Table 5—Cardiac Intraoperative and Postoperative Complications in 51 Patients with Mild to Moderate and Marked H-V Prolongation

Intraoperative complications (total) 21 56.7 12 85.7 <0.05
Hypotension 3 14.2 — —
Sinus bradycardia and hypotension 3 14.2 1 8.3
Marked sinus bradycardia 4 19.0 — —
Atrial tachyarrhythmias 4 19.0 3 25.0
Premature ventricular beats 7 33.3 5 41.6
Ventricular tachycardia — — 1 8.3
Ventricular fibrillation — — 2 16.6

Postoperative complications (total) 13 35.1 12 85.7 <0.01
Angina 3 23 2 16.6
Myocardial infarction 1 7.6 2 16.6
Premature ventricular beats 6 46.1 6 50.0
Atrial tachyarrhythmias 3 23 4 33.5
Ventricular fibrillation — — 3 25.0
Congestive heart failure 1 7.6 2 16.6
Acute pulmonary edema — — 2 16.6

with symptomatic heart disease.

There was one intraoperative cardiac death due to irreversible ventricular fibrillation in a symptomatic patient with LBBB and markedly prolonged H-V interval. The other symptomatic patient, with RBBB + LAH and with markedly prolonged H-V interval who presented ventricular fibrillation, responded to DC countershock. There were three postoperative cardiac deaths; two developed suddenly in the first postoperative 24 hours and were due to documented ventricular fibrillation, one developed on the fourth postoperative day because of cardiogenic shock secondary to myocardial infarction. All three patients, two with RBBB + LAH and one with LBBB, were symptomatic and showed markedly prolonged H-V interval. None of the patients who presented ventricular fibrillation had received a temporary pacemaker preoperatively.

**Discussion**

It is well known that chronic bifascicular block often precedes the development of CHB. Although the precise factors responsible for precipitation of CHB in these patients are not known, it is reasonable to expect that the stress of anesthesia and surgery, with the accompanying risk of hypoxemia, hypotension and electrolyte disturbances, might
precipitate CHB. It is obvious that it would be useful to have a method for identifying those patients with bifascicular block who are prone to develop CHB. Theoretically, using HBE, one could predict from the prolonged H-V interval which patients are at risk for the development of CHB and might benefit from prophylactic implication of a pacemaker. However, there is little information concerning the clinical significance of bifascicular block in preoperative patients; even the prognostic significance of H-V interval in a large series of patients who present for elective major surgery has not been investigated widely. Previous reports concerning patients with bifascicular block who underwent surgical procedures concluded that the stress of anesthesia and surgery did not precipitate CHB; even patients with previous syncopal episodes showed no impairment of cardiac conduction.

In our present series, all 98 patients failed to show evidence of CHB either during the intraoperative or postoperative period. We found no instance of CHB even in 11 patients with history positive for syncope. On the other hand, syncope is a common symptom in older patients with chronic bifascicular block and reflects various cardiac and noncardiac causes. Recent studies have emphasized that in patients with bifascicular block, syncope is surprisingly benign and often limited to a single occurrence; only recurrence of syncope usually reflects intermittent CHB.

Ten patients with RBBB + LPH showed no development of CHB, although previous studies reported a greater propensity to CHB for this type of bifascicular block. A recent prospective study reported that the incidence of CHB in patients with RBBB + LPH is relatively low (10 percent over a mean follow-up period of two years), similar to other types of bifascicular block.

Forty-two patients received digitalis and/or antiarrhythmic drugs (quinidine, propanolol, propranolol, ajmaline) in the usual doses; however, although these drugs might affect A-V conduction, in no patient taking these medications was impairment of A-V conduction observed, in accordance with the data of other authors.

Although it has been reported that conduction deterioration might be precipitated acutely by premature beats or by rapid atrial rhythms, possibly through a hemodynamic rather than electrophysiologic mechanism, our patients with these complications showed no impairment of A-V conduction. Fourteen patients showed markedly prolonged H-V interval greater than 75 msec, but even these patients failed to show progression to CHB. Although recent studies have suggested that a markedly prolonged H-V interval clearly is an indication that CHB is likely to occur, other investigators have not been able to find a higher incidence of CHB in patients with bifascicular block and markedly prolonged H-V interval. Concerning the anesthetic technique, it has been reported that the commonly used anesthetic drugs (meperidine, diazepam, thiopental, propranolol, pancuronium, methoxyflurane, enflurane) do not significantly impair A-V conduction. Recent studies have suggested that halothane and succinylcholine may affect conduction in the His-Purkinje system, as demonstrated by slight prolongation of H-V interval, but no case of CHB in man due to these drugs has been reported.

It would appear from the data collected in the present study that under the controlled conditions of modern anesthesia and surgery, the risk of development of CHB is small and therefore patients with bifascicular block do not require the insertion of a prophylactic pacemaker before surgery. The etiology of chronic bifascicular block is highly variable. In the present study a large number of patients had cardiac diseases in keeping with the data of other investigators.

Our patients with prolonged H-V interval showed significantly greater incidence of heart diseases and cardiac symptoms. Similar findings were reported by
other authors.\textsuperscript{11-15} As suggested by Denes,\textsuperscript{11} several mechanisms may explain the higher incidence of myocardial dysfunction in patients with a prolonged H-V interval: a) the same process, arteriosclerotic or hypertensive disease, for example, directly involves both the working myocardium and the conduction system; b) the prolonged H-V interval may reflect stretch of the left ventricle; c) the same etiologic factors are responsible for both the degenerative bilateral bundle branch disease and ventricular muscle disease. In our series, the incidence of H-V prolongation was significantly greater in patients with LBBB (70 percent) and RBBB + LPH (66 percent) than in patients with RBBB + LAH (35 percent). This observation is in keeping with a more frequent association of LBBB and RBBB + LPH with severe organic diseases.\textsuperscript{54}

Intraoperative and postoperative cardiac complications were significantly higher in patients with prolonged H-V interval and this observation appears to reflect the higher incidence of myocardial diseases in this group. Moreover, the incidence of perioperative cardiac complications in patients with H-V prolongation was significantly higher in subjects with symptomatic cardiac disease than in asymptomatic ones. It confirms the fact that the clinical course was primarily determined by the severity of heart disease rather than by the conduction disorders. It is interesting to note that ventricular fibrillation was documented to be the cause of death in three cases of sudden death. All the dying patients had markedly prolonged H-V interval and severe organic disease, further suggesting that the determinant of the prognosis was the associated heart disease rather than the conduction defect. Similarly Scheinman et al\textsuperscript{15} showed that only patients in moderate to severe congestive heart failure with a markedly prolonged H-V interval were at a higher risk of sudden death, and a recent study suggested that the ventricular fibrillation, and not the occurrence of CHB, was the most frequent mechanism of sudden cardiac death in symptomatic patients with bifascicular block.\textsuperscript{55}

In conclusion, it appears that patients with bifascicular block, undergoing anesthesia and surgery, even in presence of presumable risk factors, do not require prophylactic pacing before surgery, since the risk of CHB is low and therefore prophylactic pacing does not modify the intra- and postoperative course of these patients. The H-V duration represents a more accurate predictor of major intra- and postoperative cardiac complications (unrelated to CHB) than the surface recordings, but only in patients with symptomatic heart disease.

Therefore, our data further support the concept that high risk patients can be identified clinically, thus obviating the need to perform routine electrophysiologic studies in patients with bifascicular block undergoing surgery.

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