SUMMARY The risk of advanced atrioventricular block during anesthesia was studied prospectively in 44 patients with right bundle branch block and left axis deviation who underwent a total of 52 operations over a 14 month period. All patients had continuous electrocardiographic monitoring throughout anesthesia induction, operation, and surgical recovery. Of the 52 operative procedures, 24 were done under general anesthesia, 11 under spinal, and 17 under local. The preoperative cardiac rhythms were atrial fibrillation in two patients, atrial tachycardia with block in one patient, atrial flutter in one patient, and sinus rhythm in the remaining patients. Temporary pacemakers were inserted preoperatively in six patients, usually because of PR interval prolongation on the preoperative electrocardiogram. There was only one episode of transient complete heart block in 51 of the 52 operative procedures. In two of the six patients with temporary pacemakers, significant pacemaker-related ventricular irritability occurred. This study indicates that temporary pacemaker insertion is rarely required in patients with chronic right bundle branch block and left axis deviation who require noncardiac surgery.

ALTHOUGH PATIENTS who develop complete heart block commonly have preceding complete right bundle branch block and left axis deviation on the electrocardiogram, the incidence of progression to complete heart block in prospective studies of patients with this form of bifascicular block appears to be less than 10%. Cardiologists at our hospital are frequently consulted on the question of standby cardiac pacemaker placement when patients with this electrocardiographic abnormality require surgery. The assumption has been that the stress of anesthetic induction and surgery might predispose patients with complete right bundle branch block and left axis deviation to advanced heart block.

We have recently followed prospectively through surgery a number of such patients in an attempt to determine the intraoperative risk of their developing advanced atrioventric-
ular block. Our aim was to determine the need for prophylactic temporary pacemaker insertion in such patients.

Methods

Over the 14 months between July 1973 and September 1974, all tracings received in the Electrocardiographic Laboratory at the Massachusetts General Hospital were screened for the presence of right bundle branch block with left axis deviation. To satisfy our criteria for right bundle branch block, the QRS duration in one of the standard leads had to be at least twelve hundredths of a second, and there had to be an rSR' complex in lead V1. Left axis deviation was defined as an axis at or more leftward than −30 degrees in the absence of standard criteria for inferior myocardial infarction. Patients whose conduction pattern fit these criteria were considered to have bifascicular block.

Those patients about to have surgery other than cardiac surgery were identified and followed. Each patient had a twelve lead electrocardiogram taken as soon before and as early after surgery as feasible. In most cases, these full electrocardiograms were taken in the operating room.

All patients had continuous single lead ECG monitoring throughout their surgical procedures and in the recovery room. In addition, all patients requiring general anesthesia were monitored through induction, intubation, and extubation as well. All patients with preoperative electrocardiograms revealing first degree atrioventricular block before general anesthesia had standby temporary pacemakers placed preoperatively. In each case, a Cordis bipolar pacing electrode was inserted percutaneously through a subclavian vein with the tip positioned in the right ventricular apex. This was usually done under direct fluoroscopic visualization. The pacemaker generators were always turned off during surgery.

Patients with normal PR intervals were observed throughout surgery, with cardiac pacemaking equipment available in the operating room.

Results

Over the 14 month period of study, 44 patients with right bundle branch block and left axis deviation underwent a total of 52 operations at the Massachusetts General Hospital and the Massachusetts Eye and Ear Infirmary. Of these 44 patients, 35 were men and nine were women. They ranged in age from 40 to 91 years, with a mean age of 73 years. The duration of bifascicular block was unknown in most cases, being definitely greater than three months in 14 patients, but definitely greater than one year in only eight patients studied.

One patient gave a history of syncope, that episode occurring more than one year before her operation. Eleven patients of the 44 gave a history of angina pectoris, but only three had a clinical history of myocardial infarction. An additional three patients had presumptive evidence of previous anterior wall myocardial infarction on the electrocardiogram on the basis of anteroseptal Q waves.

Table 1 shows the prevalent cardiac rhythms as well as the form of anesthesia administered during the 52 surgical procedures. On the preoperative tracings, two patients were in atrial fibrillation, one in atrial flutter, and one in atrial tachycardia with variable A-V block. The latter patient was not receiving digitalis. Of the 40 patients in normal sinus rhythm, eight had PR intervals greater than 0.20 seconds.

There were no episodes of advanced heart block or significant arrhythmias during intubation and surgery in 51 of the 52 operative procedures. Transient complete heart block occurred in one patient during intubation (fig. 1). This patient had a normal PR interval on the preoperative electrocardiogram. A temporary pacing monitor was placed, and the operation (a hip replacement) proceeded without further incident.

Temporary pacemakers were implanted prior to general anesthesia in six patients. A temporary pacemaker was placed in five patients because of a prolonged PR interval, and in one patient because of transient complete heart block induced by carotid sinus massage. No episodes of complete heart block occurred in the six patients with temporary pacemakers. However, in two of the patients, significant ventricular irritability occurred in the immediate postoperative period (fig. 2). The ventricular irritability resolved in both patients upon removal of the temporary pacemakers. In both cases the temporary pacemaker had been previously placed with fluoroscopic guidance.

There were no significant differences between preoperative and postoperative electrocardiograms. Only minor changes in heart rate, axis deviation, and PR intervals were noted.

There were no immediate operative deaths. Three patients died in the late postoperative period, with none of the deaths attributable to advanced heart block.

Discussion

This study was undertaken to determine the need for temporary pacemakers in surgical patients with right bundle branch block and left axis deviation. At the Massachusetts General Hospital, which has 350 surgical beds, this form of bifascicular block is relatively common, and is encountered approximately 50 times a year among patients being screened for noncardiac surgery. The results of our study indicate that the routine preoperative placement of cardiac pacemakers in patients with right bundle branch block and left axis deviation who are going to surgery does not seem to be justified. The risks of advanced atrioventricular block would appear to be low, and the hazards of temporary pacemaker insertion and maintenance in these patients is a factor to be considered.

The single patient who advanced to complete atrioventic-
Atrial block did so during intubation. The progression to complete block occurred by a type I mechanism since there was definite PR interval prolongation prior to block. This is presumptive evidence that the block involved the A-V node rather than the remaining left posterior fascicle. Hence none of the patients in this series progressed to complete heart block by a type II mechanism.

If patients with right bundle branch block and left axis deviation are at risk of developing advanced block during surgery, it would appear that the risk is greatest during the parasympathetic discharge which accompanies intubation. However, it is doubtful that this parasympathetic discharge and the bradycardia which it produces are more common in patients with bifascicular block than in those with completely normal conduction. It can usually be avoided if emphasis is placed upon performing as smooth an induction and intubation as possible. Should increased vagal tone occur, it appears to be both brief and self-limited. The cautious use of atropine sulfate may be indicated in selected cases.

Prior studies in the need for prophylactic temporary pacing in patients with bifascicular block undergoing noncardiac surgery have either been retrospective or involved a small number of patients. Berg et al. studied in retrospective fashion the medical records of 30 patients with "bilateral bundle branch block" who underwent 36 surgical procedures. Twenty-six of their patients had right bundle branch block and left axis deviation, the remaining four having left bundle branch block and first degree heart block.

**Figure 1.** A rhythm strip (lead II) during intubation in patient A.C. demonstrates sinus slowing, sinus arrest, and high-grade atrioventricular block.

**Figure 2.** Electrocardiographic leads V3 and V5 in patient A.C. demonstrate ventricular tachycardia.
There were three postoperative deaths, which the authors felt were not attributable to advanced heart block. One patient developed regular bradycardia at 40 beats per minute immediately postoperatively. An ECG was interpreted as showing sinus bradycardia, and the pulse quickened following the intravenous administration of atropine sulfate. The authors concluded that “although the impression of the physicians in attendance was that of a vasovagal reaction to the pain in anesthesia, transient complete heart block could not be ruled out.”

Venkataraman et al.7 studied retrospectively 38 patients with right bundle branch block and left anterior hemiblock who underwent surgical or endoscopic procedures from 1968-1973. Seven patients had additional first or second degree atrioventricular block. The authors report that two of these seven developed bradycardias requiring treatment. Preoperative treatment with atropine, digitalis, or antiarrhythmic agents did not affect the incidence of these complications. They concluded that in patients having right bundle branch block with left anterior hemiblock and first or second degree atrioventricular block “pacemaker insertion may be warranted.” The form of bradycardias developed by this subset of patients is not specified in their paper.

Kunstad et al.8 studied prospectively 24 patients with “bifascicular block” who underwent 38 operations, 21 of the 24 subjects having right bundle branch block and left anterior hemiblock. Of the 38 operations, 13 were performed after insertion of a prophylactic pacemaker. Constant intraoperative ECG monitoring did not disclose any episodes of advanced atrioventricular block. There were no complications due to insertion of the temporary pacemakers, which in their institution are introduced via the femoral or antecubital vein. His bundle recordings were performed in three patients with bifascicular block who underwent surgery, and the results of the His studies appear to be noncontributory.

Escher9 has cited a low risk of temporary pacemaker insertion and maintenance using the subclavian route. In addition, she argues that tip malposition is not a problem if the pacemaker is implanted with fluoroscopic guidance. However, we feel that the unconscious surgical patient who is being positioned and transported with a temporary pacemaker in place may be at increased risk of dislodgement of the pacemaker tip from the right ventricular apex into the right ventricular cavity, where it can produce ventricular irritability.

Few of our patients had a long PR interval, and our findings cannot be extrapolated to the subset of patients with this additional abnormality. Similarly, we have not studied the effects of surgical stress upon patients with right bundle branch block and right axis deviation. Recent work would indicate that the rate of development of complete heart block among the latter patients is low,10 but the effects of surgical stress on a large series of these patients remain to be studied.

At the present time, we continue to recommend the preoperative placement of temporary pacemakers in patients with the additional history of syncope, unstable angina pectoris, or a recent myocardial infarction. The risk of advanced block in patients with bifascicular block and acute ischemia is well documented,11 and our findings do not negate those data. The significance of PR interval prolongation remains unsettled, as we have indicated, and we continue to recommend standby pacemakers in patients with this additional problem. This policy may be overly cautious and could change as we gain adequate experience with this subgroup of patients.

Clearly, as a minimal precaution, all patients with right bundle branch block and left axis deviation should have continuous ECG monitoring throughout operative or perioperative procedures which are likely to stress the conducting system of the heart.

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The risk of advanced heart block in surgical patients with right bundle branch block and left axis deviation.

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