Anesthesiology
73:772–774, 1990

Guide Wire as a Cause of Complete Heart Block in Patients with Preexisting Left Bundle Branch Block

N. TONY EISSA, M.D.,* VLADIMIR KVETAN, M.D.†

Catheter-induced arrhythmia is a well-recognized complication encountered during insertion of conventional or flow-directed balloon-tipped catheters. The most serious of these complications include complete heart block and advanced ventricular arrhythmias (*i.e.*, multifocal premature ventricular contractions, ventricular tachycardia, or ventricular fibrillation).[1,2] Of special concern is induction of right bundle branch block (RBBB) during cardiac catheterization with the serious potential of developing complete heart block (CHB) in patients with preexisting left bundle branch block (LBBB). We describe a case of iatrogenically induced asystole due to the production of bilateral bundle branch block and the absence of an escape rhythm in a patient with a preexisting LBBB.

CASE REPORT

An 80-yr-old white man with a history of LBBB was admitted for surgical resection of a left colonic mass found on barium enema examination. Electrocardiogram on admission showed a regular sinus rhythm, P-R interval of 0.26 s, and LBBB (fig. 1). On the third hospital day, the patient underwent transverse colectomy. The anesthesia and surgery were without incident, and the patient was transferred, with his trachea still intubated, to the recovery room. In the recovery room, insertion of a central venous catheter to provide postoperative total parenteral nutrition was attempted. During insertion of the guide wire, the patient developed nonconducted P waves and hypotension, and a systolic blood pressure of 40 mmHg was recorded followed by asystole (fig. 2). While resuscitation was carried out, a temporary pacemaker was inserted that resulted in the restoration of pulse and blood pressure. The heart was paced at a rate of 70 beats per min. Systolic blood pressure remained below 90 mmHg, and vasopressor therapy was required for several hours, after which a systolic blood pressure of 110 mmHg without vasopressors was reported. On the seventh hospital day, the temporary pacemaker wire was removed. During its removal, the patient had an episode of five consecutive nonconducted P waves that were followed by a return to regular rhythm. A permanent pacemaker was inserted on the 38th hospital day, and 6 days later, the patient was discharged home in stable condition.

DISCUSSION

Complete heart block is a well-documented complication known to occur during catheterization of one side of the heart when a contralateral BBB is present. Mechanical trauma induced by the catheter is the likely cause of the bundle branch block.[1,3,4] The incidence of RBBB during right heart catheterization is about 5% and is the same during insertion of conventional His's bundle catheters or pulmonary artery catheters.[1,3,5]

Right bundle branch block is usually transient (with a mean duration of less than 24 h) and requires no intervention.[2,6] Left fascicular block, both anterior and posterior, has been reported to accompany catheter-induced RBBB. This may be explained by assuming that left fascicular blocks and RBBB can be produced by lesions limited to His's bundle. Longitudinal dissociation of conduction within His's bundle must be present for this to occur, but the exact mechanism remains unclear.[7] The incidence of CHB resulting from catheterization of the right heart is rare, with an incidence of about 0.1%. In one review of 12,367 cardiac catheterization procedures, heart block was noted only in seven patients.[8] In 1984, Shah *et al.* examined the complications associated with insertion of 6,245 consecutive pulmonary artery catheters and recorded only three cases of RBBB and one case of CHB.[9] Morris *et al.*, in 1987, reported no incidence of CHB during 82 pulmonary artery catheterizations in 47 patients with LBBB.[10] Recently, in 1989, Sprung and coworkers found an incidence of 3% of new RBBBs during 279 pulmonary artery catheterizations, and none of the 14 patients with preexisting LBBB developed CHB. They concluded that the incidence of CHB during pulmonary artery catheterization of patients with previous LBBB was not higher than the incidence of RBBB in patients without underlying conduction defects.[5]

However, in an investigation of 447 patients undergoing electrophysiologic studies where the incidence of iatrogenically induced RBBB was 5%, the incidence of CHB in patients with preexisting LBBB was 23%. The reason for the high incidence of RBBB in patients with preexisting LBBB in this study is not clear.[1] Since catheter-

* Post-doctoral Research Fellow, Meakins-Christie Laboratories, McGill University, Montreal, Quebec, Canada.

† Director, Critical Care Division, Department of Anesthesiology, Montefiore Medical Center; Associate Professor of Anesthesiology, Albert Einstein College of Medicine, Bronx, New York.

Received from the Division of Critical Care Medicine, Department of Anesthesiology, Montefiore Medical Center, Albert Einstein College of Medicine, Bronx, New York. Accepted for publication April 30, 1990.

Address reprint requests to Dr. Eissa: Meakins-Christie Laboratories, McGill University, 3626 St. Urbain Street, Montreal, Quebec, Canada.

Key words: Complication: complete heart block. Heart, arrythmia: complete heart block.

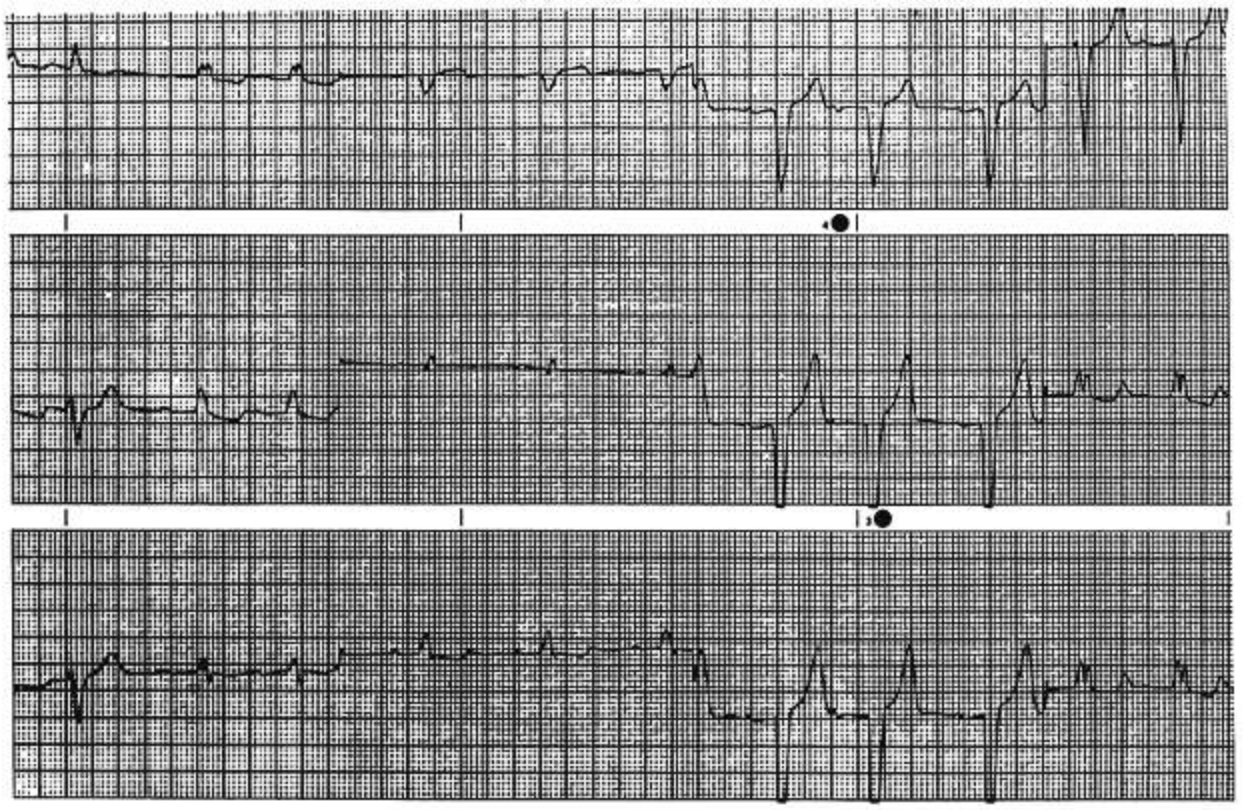

FIG. 1. Electrocardiogram on admission showing regular sinus rhythm, left bundle branch block, and first-degree A-V block.

induced RBBB is more common, CHB occurring during right heart catheterization in a patient with preexisting left BBB would more likely be due to impingement of the catheter upon the right bundle branch than from direct impingement of the catheter upon the atrioventricular (AV) node of His's bundle.[11] Complete heart block also was reported during cardiac catheterization of the left heart in patients with preexisting RBBB.[8,11]

Prophylactic insertion of a temporary pacemaker prior to catheterization of the contralateral ventricle in patients with unilateral BBB remains controversial. In its favor is the potentially fatal consequences of developing CHB[3,12,4]

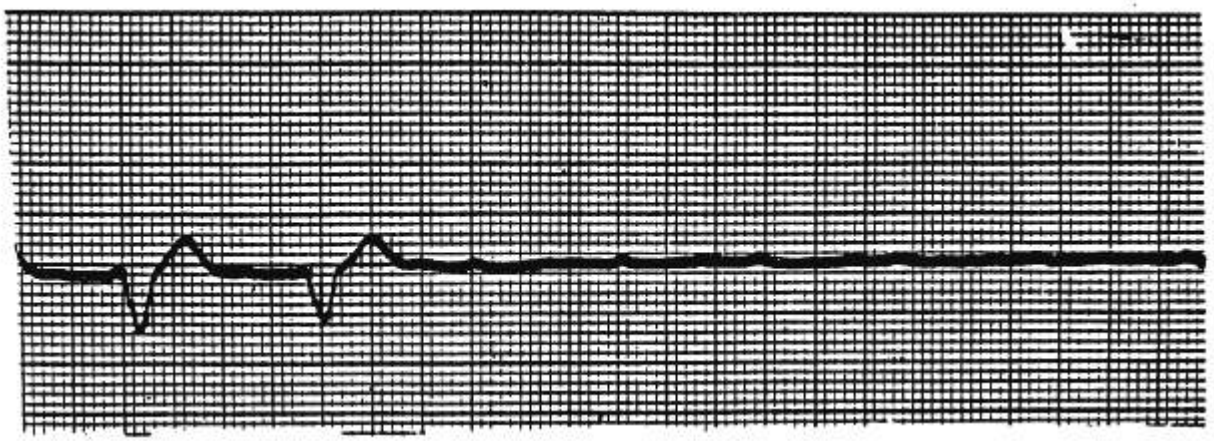

FIG. 2. Electrocardiographic tracing showing nonconducted P-waves during guide wire insertion.

and against it is the very low incidence of CHB. Recently, the use of standby external pacemakers and having equipment for transvenous pacemaker insertion available during pulmonary artery catheterization, rather than prophylactic pacemaker insertion, have been proposed.[5]

In a recent report, inadvertent introduction of the guide wire to the right ventricle resulted in ventricular fibrillation.[13] The same authors reported results from a prospective study where they found that the incidence of arrhythmias during uncontrolled guide wire insertion was about 60% and the incidence of advanced ventricular arrhythmias was about 20%. These figures almost approach the figures obtained during right heart catheterization.[13] On the other hand, in a second group of patients where the introduction of the guide wire was carefully controlled so that it did not exceed 22 cm, the incidence of arrhythmias was reduced by 70%.[13] We noted similar findings during insertion of guide wires in monitored patients.‡

In the case presented here, the patient had preexisting LBBB and first degree heart block. The patient developed catheter-induced block either at the AV node or, more likely, the right bundle producing bilateral bundle branch block. Unfortunately, the patient did not have an escape rhythm and had only nonconducted P waves before developing asystole. Three weeks later during removal of the temporary pacemaker, the patient had a transient episode of bilateral bundle branch block (resulting in five consecutive nonconducted P waves).

This case emphasizes the risk of arrhythmia that exists during right heart catheterization if the guide wire is allowed to reach the right ventricle. Guide wires are used routinely during insertion of central venous catheters, pulmonary artery catheters, and temporary pacemakers. While the latter two are inserted while the patient's blood pressure and ECG are being monitored, the former is usually inserted without monitoring and often by less qualified personnel. Guide wires are more rigid, less flexible, and are not balloon-tipped, which make them theoretically more arrhythmogenic once introduced. It would be ideal if guide wires had external markings to denote the length in centimeters. Extra care should be exercised during insertion of guide wires in patients who are at higher risk, *e.g.*, patients with LBBB. The wire should never be introduced more than 20 cm, and the patient's ECG should be monitored even if the guide wire is only used to insert any central venous catheter.

‡ Unpublished observations.

References

1. Akhtar M, Damato AN, Gilbert-Leeds CJ, Batsford WP, Reddy CP, Gomes JC, Calon AH, Dhatt MS: Induction of iatrogenic electrocardiographic patterns during electrophysiologic studies. Circulation 56:60–65, 1977
2. Sprung CL, Pozen RG, Rozanski JJ, Pinero JR, Eisler BR, Agustin C: Advanced ventricular arrythmia during bedside pulmonary artery catheterization. Am J Med 72:203–208, 1982
3. Thomson IR, Dalton BC, Lappas DG, Lowenstein E: Right bundle-branch block and complete heart block caused by the Swan-Ganz catheter. ANESTHESIOLOGY 51:359–362, 1979
4. Abernathy WS: Complete heart block caused by the Swan-Ganz catheter. Chest 65:349, 1974
5. Sprung CL, Elser B, Schein RM, Marcial EH, Schrager BR: Risk of right bundle-branch block and complete heart block during pulmonary artery catheterization. Crit Care Med 17:1–3, 1989
6. Luck JC, Engel TR: Transient right bundle branch block with "Swan-Ganz" catheterization. Am Heart J 92:263–264, 1976
7. Castellanos A, Ramirez AV, Mayorga-Cortes A, Pefkaros K, Rozanski JJ, Sprung C, Myerburg RJ: Left fascicular block during right-heart catheterization using the Swan-Ganz catheter. Circulation 64:1271–1276, 1981
8. Patten RD, Ballantyne F, Ryan GF, Goldstein S, Heinle RA: Bundle of His recording of complete heart block during cardiac catheterization: Electrophysiologic documentation of bilateral bundle branch block. Am Heart J 81:108–113, 1971
9. Shah KB, Rao TK, Laughlin S, El-Etr A: A review of pulmonary artery catheterization in 6245 Patients. ANESTHESIOLOGY 61: 271–275, 1984
10. Morris D, Mulvihill D, Lew WY: Risk of developing complete heart block during bedside pulmonary artery catheterization in patients with left bundle-branch block. Arch Intern Med 147: 2005–2010, 1987
11. Stein PD, Mathur VS, Herman MV, Levine HD: Complete heart block induced during cardiac catheterization of patients with preexistent bundle-branch block. Circulation 34:783–791, 1966
12. Kimbiris D, Dreifus LS, Linhart JW: Complete heart block occurring during cardiac catheterization in patients with preexisting bundle branch block. Chest 65:95–97, 1974
13. Royster RL, Johnston WE, Gravlee GP, Brauer S, Richards D: Arrhythmias during venous cannulation prior to pulmonary artery catheter insertion. Anesth Analg 64:1214–1216, 1985