Editorial

Problems and Responsibilities in the Use of Electric Pacemakers

There is general agreement among workers in the field on the indications and the value of long-term electric stimulation for the control of cardiac rhythm, even though opinions vary widely about most of the details. For this discussion the many points in dispute may be grouped in the major areas of the specific indications, the artificial pacemaker-electrode system, and the response of the patient. Each area abounds with complex problems, any detail of which may be crucial to the success of the treatment and the life of the patient. Although Stokes-Adams disease is recognized as the primary indication for electric pacemakers, is one attack enough? Is complete heart block without symptoms an indication? Does variation in A-V block modify the need in a patient with Stokes-Adams disease? The pacemaker-electrode systems in use today vary widely in many features. With respect to the stimulus itself many differences appear: its shape, duration, and amplitude; the regularity of the stimuli, whether fixed, synchronized to atrial impulses, or "on demand" after predetermined pauses; and multiple quantitative variables in each type of system. The electrodes differ even more: in location, that is, unipolar or bipolar; in type of application, whether myocardial by surgical exposure or transvenous endocardial, with the numerous variations of each type; and in structure, material, size, and configuration of the electrode and its insulation.

We need not detail further the multiplicity of variations in this form of treatment today. Choice among the many possibilities depends on knowledge of underlying concepts in the many disciplines involved. For example, decisions about the stimuli and the electrodes depend on metallurgical, electrical, chemical, and physiological considerations of the causes of wire breakage, the effects of polarized solutions on metal, the response of tissues to foreign bodies, the determinants of the thresholds for myocardial stimulation, et cetera. Selection of regularity and rate of stimulation involves considerations of the vulnerable period and repetitive responses, of the variability of A-V block, of the effects of rate and rhythm on cardiac output, and of the "critical rate" to suppress ventricular irritability.

The differences among workers in the field arise from the incomplete state of knowledge concerning the many specialized technological and clinical problems. Intensive research in the laboratory and accumulated experience with patients may be expected in time to settle many of the disputed points, to reduce the multiplicity of approaches, and to improve therapy. For these purposes, although the emergency problems of Stokes-Adams attacks require immediate effective management by physicians on the scene, the long-term treatment of patients with electric pacemakers is best carried out by groups interested in all the problems and willing not only to implant the pacemaker initially but also to undertake the vital responsibility for continued care that is so well stated in the two accompanying editorials.

Our own pertinent experience consists of a series of 174 patients in whom our group (Howard A. Frank, Arthur J. Linenthal, and myself) has implanted fixed-rate pacemakers (Electrodyne TR-14) at the Beth Israel Hospital, Boston, since July 1961. Our follow-up observations have centered primarily on the stimulus rate, which we have found to be the

From the Departments of Medicine and Surgery, Beth Israel Hospital and Harvard Medical School, Boston, Massachusetts.

Circulation, Volume XXXVI, October 1967

478
most useful index of pacemaker function. We ask the patient to count his pulse daily and to report consistent variations of over 2 beats per minute. When the pulse is irregular, however, its rate is not useful for this purpose unless it is slow, that is, 50 per minute. The patient is also told to report even minor symptoms since pacemaker failure may be manifested early by only occasional ineffectiveness. He is also examined by either the referring physician or our group at 4 to 6-month intervals and electrocardiograms are obtained to determine precisely the pacemaker rate and effectiveness. Acceleration of about 5 beats per minute usually results from wire breakage. Failure of other components which may produce faster rates have been extremely rare in our experience. Slowing usually results from battery exhaustion and warrants replacement of the instrument when the rate has dropped 10 beats per minute. Some instruments have slowed prematurely due to changes in other components. The amplitude of the stimulus artifact measured in the electrocardiographic limb leads often falls significantly with battery depletion but is not a reliable guide. We have recently been studying the shape and the time characteristics of the stimulus artifact obtained from surface electrodes and observed on an oscilloscope. At present we think we can identify battery exhaustion by a slowing in the rise time. We do not replace the pacemaker unit at arbitrary intervals but only because of malfunction or evidence of battery exhaustion.

Paul M. Zoll
Problems and Responsibilities in the Use of Electric Pacemakers
PAUL M. ZOLL

Circulation. 1967;36:478-479
doi: 10.1161/01.CIR.36.4.478
Circulation is published by the American Heart Association, 7272 Greenville Avenue, Dallas, TX 75231
Copyright © 1967 American Heart Association, Inc. All rights reserved.
Print ISSN: 0009-7322. Online ISSN: 1524-4539

The online version of this article, along with updated information and services, is
located on the World Wide Web at:
http://circ.ahajournals.org/content/36/4/478.citation

Permissions: Requests for permissions to reproduce figures, tables, or portions of articles
originally published in Circulation can be obtained via RightsLink, a service of the Copyright
Clearance Center, not the Editorial Office. Once the online version of the published article for
which permission is being requested is located, click Request Permissions in the middle column of
the Web page under Services. Further information about this process is available in the Permissions
and Rights Question and Answer document.

Reprints: Information about reprints can be found online at:
http://www.lww.com/reprints

Subscriptions: Information about subscribing to Circulation is online at:
http://circ.ahajournals.org/subscriptions/