

6/18 to no perception of light. Frequent periods of obscured vision occurred in two of these patients and was in most cases due to benign intracranial hypertension. Fluorescein angiography again demonstrated a typical picture. A very few narrow and threadlike branches to the retinal arteries

were seen while the disc was swollen, but these did not show any fine network. There might also have been associated ischaemic changes in the retina.

These findings showed the features of the evolution and natural history of papilloedema, and also confirmed the value of fluorescein

angiography at each stage—especially in the early and late groups. The changes in the first four stages were reversible, but in the last irreversible changes had occurred. The role of the ophthalmologist in recognizing and eliminating this group was therefore very important.

NEW APPLIANCES

Simple Unit for Temporary "On Demand" Pacing

Dr. S. C. JORDAN, senior registrar, and Mr. L. M. CLARKE, chief technician, Cardiac Department, Bristol General Hospital, write: In addition to its use in patients with chronic heart block, artificial pacing of the heart may be required as a temporary measure in patients with heart block complicating myocardial infarction and after intracardiac operations. In these circumstances the cardiac rhythm is often unstable, and to avoid the problems of competition between artificial and intrinsic pacemakers the technique of "on demand" pacing has been developed whereby the ventricles are paced only when a ventricular contraction does not occur within a preset period. The most common system is to use the QRS complex to inhibit the generation of an impulse from the artificial pacemaker ("ventricular-inhibited" pacemaker). Most of the commercial units are either expensive or cumbersome, and since pacing may be required for up to three to four weeks we felt that there was a place for a small external "on demand" pacemaker that could be attached temporarily to the patients.

General Principles.—It is most convenient and reliable to use the same electrode system both for sensing ventricular depolarization and for pacing, since this reduces the number of wires attached to the patient and also obviates inhibition of the pacemaker due to artifacts from poor skin contact. In treating heart block complicating myocardial infarction a transvenous unipolar or bipolar endocardial electrode is most often used, and after intracardiac surgery either two epicardial electrodes or one epicardial and one indifferent electrode are used. Electrocardiograms recorded from either system usually give large QRS voltages, though we have sometimes found that after extensive myocardial infarction the endocardial electrocardiogram may be reduced in voltage. When any apparatus with a low impedance is connected to the electrode system the input

signal is reduced. If the pacemaker has too low an impedance the input signal may be reduced to below the sensing threshold in patients with low-voltage endocardial electrocardiograms (Fig. 1). The pacemaker is designed so that it will be inhibited by the high-frequency QRS complexes, but ignores the low-frequency P and T waves (Fig. 2).

for short periods, but to reduce the risk of late perforation of the heart when pacing for more than a few days is expected to be required a St. George transvenous unipolar electrode is used and an indifferent electrode inserted subcutaneously in the arm. The electrode tip is impacted in the right ventricle so as to give an endocardial electrocardiogram with a "contact" pattern (Goetz *et al.*, 1968) and a threshold below 1 volt at 0.8 millisecond duration. Movements of the shoulder are restricted by an armband and a chest strap.

If the patient has a slow rate the pacemaker is set to stimulate the ventricle at 70 to 80 impulses a minute. If he is normally in sinus rhythm it is set to about 10 impulses a minute below his own rate. The pacemaker is usually left connected for up to three weeks after sinus rhythm has been re-established. The pacing threshold is checked every day for three to four days and then every two to three days. Pacemaker function is checked firstly by increasing the rate to above the patient's own rate and then by applying pressure to the carotid sinus (Goetz *et al.*, 1968).

Precautions.—Like most ventricular-inhibited or ventricular-triggered pacemakers this unit is sensitive to interference from electrical equipment. Short-wave diathermy machines cause inhibition of pacing at distances up to 8 ft. (244 cm.) according to type of equipment and orientation. Electric shavers cause inhibition only when in direct contact, and electric blankets only when switched on or off within a few inches. Nevertheless, such pieces of equipment should be kept well away from patients on "demand" pacemakers.

Patients Treated.—The unit has been used on six patients with heart block complicating myocardial infarction, three with postoperative heart block, and nine with intermittent idiopathic heart block, and has functioned without fault. In one patient with idiopathic intermittent heart block inhibition of the first prototype pacemaker could not be established owing to a low and fragmented QRS complex from the endocardial lead, but the mark II pacemaker, which reduced the QRS voltage less, performed satisfactorily.

We are grateful to Mr. G. Holland and Mr. G. Ridyard, of Meditek Ltd., for help in the technical design of the pacemaker. The M.P. 10 unit is now available from Meditek Ltd., Avondale Trading Estate, Cwmbran, Mon.

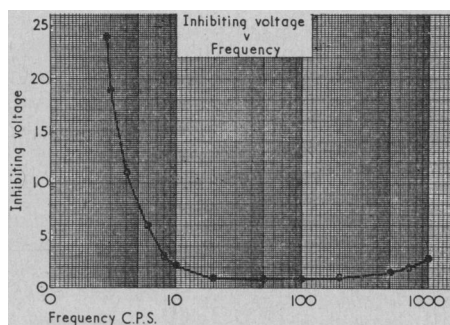


FIG. 2.—Minimum inhibiting signal (mV peak-to-peak sine wave) against frequency. Input source/600 ohms impedance.

The unit described has been designed with controls to vary rate and voltages of the pacing impulses (Fig. 3). These are stiff enough to prevent accidental movement but can be moved by hand. It is powered by a standard 9-volt Mallory battery, which is easily replaceable.

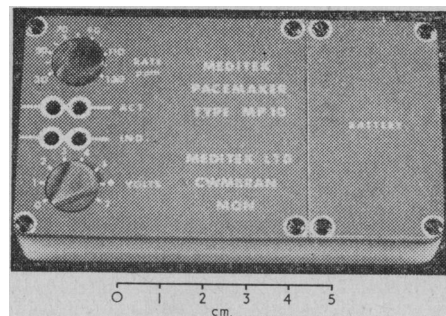


FIG. 3.—"On demand" pacemaker.

Specification.—Input impedance 8.2 kohms; rate control 30–130/minute; voltage control 0–7 volts; pulse duration 1 millisecond; battery: 9-volt Mallory cell, type TR 146X; battery life on continuous pacing two months; dimensions $3\frac{3}{4}$ by $2\frac{1}{4}$ by $\frac{3}{8}$ in. (9.5 by 5.7 by 1.9 cm.); weight 5 oz. (140 g.).

Technique.—For speed of insertion we usually use an arm vein, though percutaneous insertion into the subclavian vein has also been used. A bipolar Goetz electrode is used

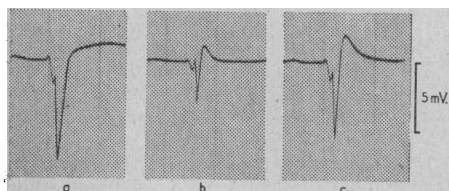


FIG. 1.—Cavity leads recorded from patient with 2:1 atrioventricular block with unipolar endocardial wire and indifferent arm lead. (a) Unloaded. (b) With prototype pacemaker connected (impedance 5 kohms). (c) With modified pacemaker connected (impedance 8.2 kohms). (Recorded with high impedance photographic recorder.)

REFERENCE

- Goetz, R. H., Goldstein, J. V., Frater, R. W. M., and Berkovitz, B. (1968). *Journal of the American Medical Association*, 205, 657.