MEDICINE

Medicine Turns to Electronics

Medicine is getting some powerful assistance from electronics. Together they are bringing treatment and diagnosis to a level of proficiency otherwise unattainable.

By RALPH SEGMAN

➤ THE WORLD of medicine has become electrified.

Once dependent solely on their human senses and skills, physicians in growing numbers are turning to electronic devices for help in surgery, diagnosis and treatment.

One machine automatically brings back to life patients whose hearts stop beating. Another controls the critical anesthesia levels during surgery.

Devices currently in use make blood counts; record brain waves; detect cysts; radio information from the stomach; see chemicals at work in human cells; and substitute for heart, lung and kidney functions.

This is made possible by the electron, one of the fundamental building blocks of matter. The electron is so elusive, tiny and fast-moving—at top speed it could circle the earth more than seven times a second—that scientists are in the dark about much of its nature. Yet enough is known to have put it to work as a servant of man.

Some of the most everyday events depend on electric currents, the flow of great numbers of electrons. They light lamps, run machines, make telephone conversations possible, bring pictures to the television screen and start automobile motors. And now electronics has made its entry into the very marrow of human life and medicine.

Heart Pacemaker

One of the more dramatic of the electronic devices is the heart monitor and pacemaker, developed about two years ago by Dr. Paul M. Zoll of Beth Israel Hospital in Boston, Mass. Kept at the patient's bedside or in the operating room, it performs like a mechanical physician, ever alert for cardiac arrest.

The monitor and pacemaker may be linked to work automatically in the following way: A few seconds after the patient's heart stops beating, the monitor causes a nurse-summoning bell to jangle and automatically switches on the pacemaker. Through electrodes strapped to the patient's chest the pacemaker shoots 60 jolts of electricity a minute to get the heart beating normally again. Speed is essential here, since man normally can live only about four minutes after heart stoppage.

Dr. Zoll reckons there are hundreds of these machines now in operation and that hundreds of lives have been saved.

In surgical practice, anesthesia levels are maintained by a physcian who constantly checks the patient's pulse, blood pressure, breathing rate, eye dilation and other outward signs. At the Mayo Clinic, Rochester, Minn, an electronic machine is automatically adjusting anesthesia levels based on changes in brain waves.

While the surgeon is working on major human organs, there are machines to temporarily take over the functions of the organs. One by-passes blood around the heart. Electronic sensing and control devices maintain the critical blood temperature and pressure levels. Paralleling the artificial heart, there are the artificial lung and kidney, each by-passing the natural organ while it is being examined or repaired.

The use of electronics in diagnosis has advanced to the point where most physicians have access to one or more devices in their own office or in hospitals.

Late last year, the first long-distance diagnosis of its kind took place when a patient in the Naval Medical Center, Bethesda, Md., was examined by a group of physicians in Kansas City, Mo. Electronic devices strapped to the man's body recorded cardiac and respiratory information and immediately transmitted it nearly 1,000 miles to various "scopes" and recorders in Kansas City where specialists described the patient's condition. This system shows promise for cases in which advice of experts, who are not at hand, is needed.

Ultrasonic devices employing electronic principles detect cysts and growths which X-rays cannot locate because of their similarity to surrounding tissues.

Reduction of the danger of X-ray injury to the patient and the diagnosing physician has been found in electronic amplification, permitting a smaller X-ray dose.

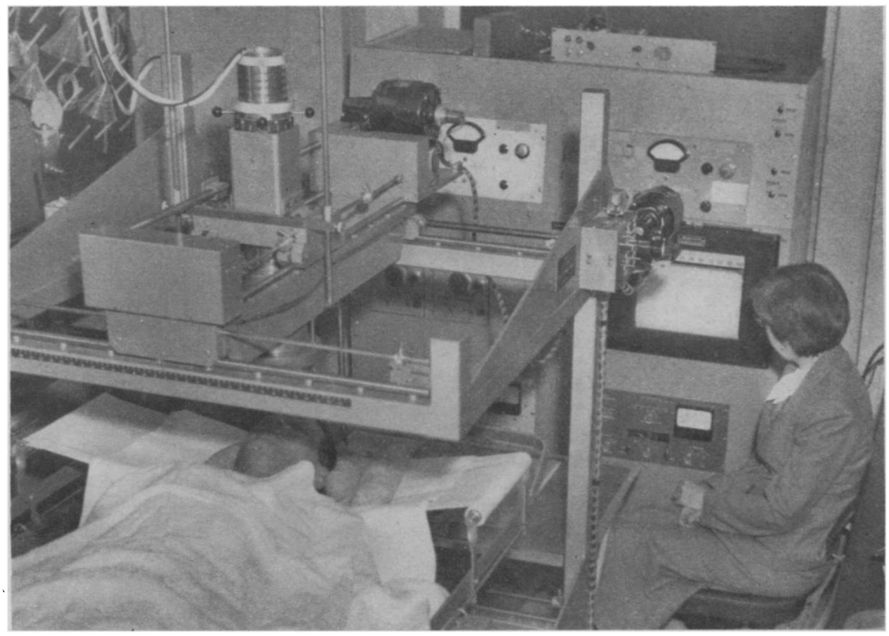
Another device, the brain tumor scanner, is used at the National Institute of Neurological Diseases and Blindness, a division of the National Institutes of Health, Bethesda, Md. Radioactive iodine-131 is injected into the patient. It concentrates in the tumor where it is detected by the scanner. The radiations activate electrons that are then detected by an electronic tube. The result is a pattern of dots locating and sizing the tumor.

Body Sounds Amplified

An electronic stethoscope picks up heart sounds, chest vibrations and sounds from other organs and amplifies them for a telephone headset or loud-speaker. It yields far more information than conventional stethoscopes.

One of the most ingenious diagnostic devices is the so-called radio pill, a tiny radio transmitter that can easily be swallowed Its signal frequencies, sensitive to pressures in the stomach, give the receiver outside the body telltale information.

Blood pressure, spinal fluid pressure and brain waves can be measured electronically.



BRAIN TUMOR SCANNER—This patient has received an injection of radioactive iodine-131. If a tumor is present, the isotope concentrates in it and the electronic brain scanner detects the iodine's radiations. The result is a pattern of dots on the graph locating and sizing the growth. The photograph comes from the National Institute of Neurological Diseases and Blindness, Bethesda, Md.

A new instrument counts red and white blood cells and tumor cells 20 times faster than any trained technician. An automatic analyzer calculates and records glucose, nitrogen and phosphate levels in the blood; three such instruments with two part-time technicians can replace six full-time technicians.

Masses of information gathered by all these instruments are sometimes fed into electronic computers that present the diagnostician with processed material far more rapidly in some cases than human experts could.

Physician's Helpers

These and other extraordinary electronic devices are intended as aids, not replacements, for the physician. There is no doubt that the convergence of the relatively new science of electronics and the old art of medicine has been a fruitful one. And the relationship promises to become closer in the future.

Already, on the medical electronics horizon, new devices and ideas are appearing.

David Sarnoff, chairman of the board of the Radio Corporation of America, has said: "In theory, at least, it is conceivable that one day compact electronic substitutes will be provided on a permanent basis to replace organs that have become defective through injury or age.

"Artificial kidneys, lungs and even hearts may then become as familiar as artificial teeth or hearing aids. Indeed, one may imagine a man walking around in apparent good health with several of his organs replaced by the refined electronic substitutes of the future. Admittedly the idea is fantastic, but, as the marvels of electronics unfold, the line between fantasy and fact is ever harder to define."

Parts and Replacements

Electronic devices that automatically exercise any part of the body are already being used in the field of orthopedics for the correction and prevention of deformities.

Electronic methods are capable of amplifying feeble muscular efforts and impulses to almost any desired magnitude. The outlook—still only a hope—is for equipment which, attached to amputated limbs, will control movements of artificial arms, legs and fingers with acceptable precision.

Devices for helping the blind are in various stages of development. Some would scan books and newspapers and emit sound signals, enabling the sightless to read without the Braille system. Others would allow users to detect obstacles and changes in pavement levels.

And for the blind whose optical brain areas and optic nerves are undamaged there is hope for what might be considered one of the ultimates in medical achievement. It would be an electronic device that would gather visible light and transmit impulses to the optic nerves, which in turn would send impulses to the brain. Thus with the visual brain area stimulated, much as it is in normal sighted persons, the blind would actually see.