A SIMPLE AND INEXPENSIVE OPERATING-ROOM EKG TELEMETRY SYSTEM

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THE INCREASING COMPLEXITIES of modern surgery have been accompanied by parallel developments in the realm of anaesthesiology. Today it would be very rare for a patient to be denied surgery because of the possibility that he might not tolerate anaesthesia. Our increasing boldness in the management of the poor-risk patient is in large part due to the better methods of assessing the patient's condition on a continuing basis. We have seen the introduction of various monitors giving us moment-to-moment information on the patient's state. The constant guides thus provided have no doubt prevented many operating room catastrophes.

Many of the monitors have been of a bulky nature, and often quite expensive. Most of the time they are awkward to use because of the many connections and electrical wires creating a hazardous maze in the operating room. The complexities of all these electrical connections to the patient carry a further shock hazard which must not be overlooked.¹ Anything that either simplifies the size of monitor units or their method of connection to a patient is of interest to us.

There are many occasions when the anaesthesiologist would like to observe electrocardiographic action continuously during anaesthesia, or in the immediate pre- or postoperative periods. Too frequently, the inconveniences of the patient cable-leads and the time necessary to connect them up are deterrents. Yet it cannot be denied that many cardiac problems during anaesthesia can be prevented or modified if electrocardiographic information is continuously available. The purpose of this article is to present a simple and compact method of eliminating the patient cables entirely. It utilizes a simplified telemetry system of Canadian design and manufacture (Fig. 1).

Quickly applied disposable-type electrodes are used. The ones known as "Derma-Circs" (trade name) are recommended because they give minimal artefact. These are self-adhering, and it takes but a moment to place a small amount of non-irritating electrode jelly in the centre of these electrodes, applying one near the top of the sternum and the other on the chest wall in the vicinity of the apex beat. Two small wires clip on to these electrodes and connect to the transmitter by means of special Amphenol Micro-Med 221 connectors.

The telemetry transmitter itself is the size of a small match box and weighs 30 gm. The high quality of the electrical characteristics of the transmitter – high input impedance (1 megohm) and wide band (0.5 to 10,000 Hz) – enable this device to transmit the biological signal to a remote receiver without the introduction of unwanted artefacts. Because the transmitter is completely isolated from all other systems and is battery operated, the rejection of non-physiological signals, such as 60 Hz line interference, is extremely good. The transmitter is very

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ugged and will not be damaged by dropping or crushing. The solid-state circuitry and potted construction give the unit extreme reliability and long life. The transmitter is totally enclosed and has no power switch to wear out. The battery is inserted to start the transmission and removed when monitoring is completed. A remote battery connector can be provided for use where continuous recording is required for many consecutive days. This simple and quickly applied system will transmit the patient's electrocardiographic signal as lead II.

With no other wire or connection, this signal is received on a small frequency modulated receiver (Fig. 2) which can be close to the anaesthetist or back in some easily visible corner of the operating room. The transmitter is said to be capable of transmitting up to 100 feet. The FM receiver is small and light weight, with self-contained batteries and a small telescopic whip antenna. Owing to its small size and portability, it is especially suitable for areas where space is at a premium.

FIGURE 2

This unit has been made compatible with existing recorders. Its output level is a low impedance 100 ohm, which enables the signal on the recorder to be artefact free in an electrically "noisy" environment. Interference from other units, such as is encountered in direct cable recording, is eliminated. "Tuning" of the receiver is made very simple by means of a special tuning meter on the face of the instrument. This meter has also been arranged to serve as a battery test device so that the state of the internal batteries can be determined quickly at all

times. The EKG signal thus received can then be fed into an oscilloscope for constant direct viewing, or into a direct writing EKG recorder (Fig. 3).

Our practice is to feed the EKG signal to a small oscilloscope, which itself is connected to an EKG recorder. We may thus observe the electrocardiograph continuously, and should some phenomenon occur which we would like to record permanently, we have but to press a button to have a direct write-out strip.

FIGURE 3

Should the FM receiver be connected to a battery-operated oscilloscope and a battery operated EKG recorder, it would thus be possible to eliminate all wires except the two small ones connecting the chest electrodes to the transmitter.

We find the above described low cost monitor system very useful for everyday monitoring of the poor risk patient in surgery and it is valuable for investigational studies.

SUMMARY

A brief description is presented of an inexpensive Canadian-made EKG telemetry system for the anaesthetist's use in the operating room or the recovery area.

RÉSUMÉ

Ceci présente un système de télémetrie de l'électro-cardiogramme qui s'adapte très bien aux besoins de l'anesthésiste. C'est un système non dispendieux, d'emploi facile, et de fabrication canadienne.

ACKNOWLEDGMENTS

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REFERENCES

1. HORPES, J. A. The Electric Shock Hazard in Hospitals. C.M.A.J. 98: 1002 (1968).