**AMBULATORY ECG RECORDING. ITS REMINISCENCE, MERITS AND DEMERITS**

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In medicine, a Holter monitor (often simply "Holter" or occasionally ambulatory electrocardiography device) is a portable device for continuously monitoring various electrical activity of the cardiovascular system for at least 24 hours (often for two weeks at a time).

The first ambulatory electrocardiograms (AECG) were conducted by Norman J. Holter and Dr. W. R. Glasscock in 1961. Although Holter’s first efforts consisted of an 85 pound radio transmitter and a receiving device that required the same amount of analysis time as the time recorded, the first commercial AECG device manufactured in 1962 by Del Mar Engineering Laboratories under the name Avionics Research Products Corporation was much lighter and easier to use. Bruce Del Mar teamed up with Holter to develop and produce a smaller, lighter “Electrocardiocorder®” and high speed review technique that allowed a practical method to record and interpret long term AECGs of 24 or more hours on magnetic tape.

A large number of research and clinical findings were published immediately after the introduction of this technology to the medical community leading to wide spread acceptance of the technique by 1966. Through the Holter monitoring technique, patients’ ECGs are routinely recorded and analyzed during normal daily activity, even during sleep.

Del Mar Avionics and other medical device manufacturers continued to improve upon Holter’s earlier concepts by miniaturizing portable tape recorders, speeding up and simplifying analysis techniques and increasing the number of channels that could be recorded and analyzed.

The first commercially available systems could only record 10 hours and playback speed was limited to 60 times faster than real time. Concerns regarding the volume of data, accuracy of analysis, operator dependency/fatigue and other technical considerations resulted in the development of computerized models, "algorithms," for analysis of the ECG and summary report generation for physician interpretation.

Over the next decades, high speed playback and computer assisted analysis provided the physician with valuable information regarding the electrical activity of the patient’s heart that are especially useful for the determination of cardiac abnormalities, treatment and drug efficacy, pacemaker follow-up, Sudden Infant Death Syndrome (SIDS), differential diagnosis of patient symptoms and activity related cardiac changes.

Augmentation of the analysis technique has included refinements in arrhythmia, ST, Pacemaker and heart rate variability analysis. Signal Averaging techniques and high resolution analysis of the ECG signal have also been added to increase clinical utility of AECG. Computerized analysis of the QT-T of each normal beat is a recent innovation in the ever expanding use of Holter ECG data.

Originally designed using magnetic tape that could record only 2 channels, recording limitations such as wow, flutter, tape head misalignment and mechanical malfunctions were eliminated with the use of a PCMCIA type II digital recorder which acquired 3 Leads of 8-bit data on a removable flash memory device. As the cost and size of greater memory capacity has decreased, digital recording has improved significantly in a few short years. Capable of recording as many as 12 Leads, digital recorders can sample and store at very high rates with remarkable resolution for very long periods of time.

The Holter's most common use is for monitoring heart activity (electrocardiography or ECG), but it can also be used for monitoring brain activity (electroencephalography or EEG) or arterial pressure. Its extended recording period is sometimes useful for observing occasional cardiac arrhythmias or epileptic events which would be difficult to identify in a shorter period of time. For patients having more transient symptoms, a cardiac event monitor which can be worn for a month or more can be used.

When used for the heart, (much like standard electrocardiography) the Holter monitor records electrical signals from the heart via a series of electrodes attached to the chest. Electrodes are placed over bones to minimize artifacts from muscular activity. The number and position of electrodes varies by model, but most Holter monitors employ between three and eight. These electrodes are connected to a small piece of equipment that is attached to the patient's belt or hung around the neck, and is responsible for keeping a log of the heart's electrical activity throughout the recording period.

The major advantages of Holter monitoring are the ability to continuously record ECG data and the lack of need for patient participation in the transmission of data. The short duration of monitoring can be inadequate if symptoms are infrequent. Newer Holter monitors are now available with up to 2 weeks of recording capability. Limitations of Holter monitoring include frequent noncompliance with keeping a log of symptoms and using event markers, which significantly limits the diagnostic value of these devices. The absence of real-time data analysis can also be an important clinical limitation of these devices.