CME CREDIT ***EDUCATIONAL OBJECTIVE:*** Readers will identify patients for whom telemetry is, may be, or is not indicated

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Is telemetry overused? Is it as helpful as thought?

ABSTRACT

Cardiac telemetry is widely used in hospitals, but it is expensive and labor-intensive. Therefore, it should be used only in those most likely to benefit. The authors review the available evidence and offer their recommendations.

KEY POINTS

Guidelines from the American College of Cardiology (1991) and American Heart Association (2004) divide patients into three risk classes for whom telemetry is, may be, or is not indicated.

Few studies have addressed whether telemetry is beneficial in clinical practice.

The available evidence suggests that telemetry infrequently influences physician management decisions for patients at low risk, although it may in a relatively small subset at high risk.

Inappropriate use of telemetry is associated with unnecessary testing and treatment and higher cost of care.

Better risk-assessment and selection strategies are needed to identify patients for whom telemetry monitoring will be most beneficial.

Telemetry—from the Greek words *tele* (remote) and *metron* (measure)—for cardiac monitoring was developed in the mid-1960s by Spacelabs Medical for use in spaceflight.[1] The system was later adopted in hospitals to detect life-threatening arrhythmias.

Guidelines for the use of telemetry were published in 1991 by the American College of Cardiology (ACC)[2] in response to concerns raised by its increasing use in noncritical care settings during the 30 years after its introduction to clinical medicine. The latest revision of the guidelines was published in 2004 by the American Heart Association (AHA).[3]

However, the guidelines are based largely on expert opinion and on research data in electrocardiography. Few clinical trials of telemetry have been published, and they were either retrospective or nonrandomized. In fact, there were no published randomized trials at the time the 2004 guidelines were written. Moreover, very few of these studies evaluated the impact of cardiac telemetry monitoring on physician management decisions.

We reviewed the literature to find out how cardiac telemetry is being used in clinical practice and how it might be used more selectively. The literature search was performed using Ovid MEDLINE (1996 to present) and PubMed Central using the key search terms "cardiac monitoring," "telemetry monitoring," "telemetry," and "inpatient." References from articles identified using Ovid MEDLINE (1996 to present) and PubMed Central that were relevant to our review were also included.

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TABLE 1

Class I: Cardiac monitoring is indicated for nearly all patients...

In the early phase of acute coronary syndromes, including "rule-out" myocardial infarction (MI)

In the postoperative period after cardiac surgery

Resuscitated recently from cardiac arrest

With indications for intensive care

During acute management of poisoning with drugs or chemicals at doses known or suspected to have cardiac arrhythmic toxicity

During initiation and loading of type I or type III antiarrhythmic drugs for potentially life-threatening arrhythmias in patients clinically prone to proarrhythmic effects

Immediately after percutaneous transluminal coronary angioplasty for patients with complications of the procedure

With high-risk coronary artery lesions who are candidates for urgent mechanical revascularization

With a temporary pacemaker or transcutaneous pacing pads

Who have undergone implantation of an automatic defibrillator lead or a pacemaker lead and are considered pacemaker-dependent

With Mobitz type II or greater atrioventricular block, advanced second-degree atrioventricular block, complete heart block, or new-onset left bundle branch block in the setting of acute MI

With acute heart failure, pulmonary edema, or receiving intra-aortic balloon counterpulsation

Undergoing diagnostic or therapeutic procedures requiring conscious sedation or anesthesia

With long-QT syndrome and associated ventricular arrhythmias or any other hemodynamically unstable arrhythmia

BASED ON JAFFE AS, ATKINS JM, FIELD JM, ET AL. RECOMMENDED GUIDELINES FOR IN-HOSPITAL CARDIAC MONITORING OF ADULTS FOR DETECTION OF ARRHYTHMIA. J AM COLL CARDIOL 1991; 18:1431–1433, AND DREW BJ, CALIFF RM, FUNK M, ET AL. PRACTICE STANDARDS FOR ELECTROCARDIOGRAPHIC MONITORING IN HOSPITAL SETTINGS: AN AMERICAN HEART ASSOCIATION SCIENTIFIC STATEMENT FROM THE COUNCILS ON CARDIOVASCULAR NURSING, CLINICAL CARDIOLOGY, AND CARDIOVASCULAR DISEASE IN THE YOUNG: ENDORSED BY THE INTERNATIONAL SOCIETY OF COMPUTERIZED ELECTROCARDIOLOGY AND THE AMERICAN ASSOCIATION OF CRITICAL-CARE NURSES. CIRCULATION 2004; 110:2721–2746.

Current guidelines for telemetry monitoring are based largely on expert opinion

THREE CLASSES OF RISK

Both the ACC and the AHA guidelines divide patients into three classes on the basis of clinical conditions.[2,3]

- Class I consists of patients at significant risk of an immediate life-threatening arrhythmia, and cardiac monitoring is indicated for almost all of them (TABLE 1).
- Class II consists of patients for whom cardiac monitoring may be of benefit in some cases but is not essential for all (TABLE 2).
- Class III consists of patients at low risk or otherwise unlikely to benefit from cardiac monitoring, and for whom it is not indicated (TABLE 3).

PATIENTS AT LOW RISK DO NOT BENEFIT

Telemetry monitoring has become an essential and commonly used clinical tool in most hospital systems. However, physicians do not seem to be using the risk stratification guidelines routinely or appropriately. The result is that many patients are being monitored needlessly, because telemetric monitoring neither affects how patients at low risk are managed nor improves their clinical outcomes.

Saleem et al[4] reported that, of 105 patients at low risk who presented with chest pain and were admitted to a telemetry unit, none experienced a cardiac event or arrhythmia warranting changes in management while in the hospital.

TABLE 2

Class II: Cardiac monitoring may be indicated in some patients...

More than 3 days after an acute myocardial infarction

With chest pain syndromes

With a potentially lethal arrhythmia several days after control of the arrhythmia

At risk of cardiac arrest, respiratory arrest, or development of hypotension

Who are receiving an antiarrhythmic drug or who require adjustment of drugs for rate control with chronic atrial tachyarrhythmias

With suspected or proven hemodynamically significant paroxysmal tachyarrhythmia or bradyarrhythmia

With subacute heart failure or in the acute phase of pericarditis

With unexplained syncope or other transient neurologic signs or symptoms that might be due to cardiac arrhythmias

After uncomplicated nonurgent percutaneous transluminal coronary angioplasty or uncomplicated ablation of an arrhythmia

Who have had a pacemaker implanted within the last 48–72 hours and who are not pacemaker-dependent

In stable condition after cardiac surgery

With do-not-resuscitate orders with symptomatic arrhythmia

Who have undergone routine coronary angiography

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Physicians may overestimate the role of telemetry

Durairaj et al[5] conducted a prospective cohort study of 1,033 patients admitted consecutively from an emergency department to an inpatient telemetry unit from July 1998 to January 1999. Patients were initially stratified according to a prediction model proposed by Goldman et al[6] into groups at high, moderate, low, and very low risk. The risk groups were substratified according to the presence or absence of chest pain. The outcomes measured were transfer to an intensive care unit and a major cardiac complication, which included acute myocardial infarction, cardiac arrest, ventricular fibrillation, temporary pacemaker implantation, cardiogenic shock, emergency cardioversion, use of an intraaortic balloon assist device, intubation, and recurrent ischemic pain requiring coronary revascularization within 72 hours after admission or requiring cardiac catheterization followed by coronary revascularization before discharge from the hospital. The subgroup of patients who were classified as being at very low risk and who did not have chest pain (n = 318) did not experience any major cardiac complication.

Sivaram and colleagues[7] studied the role of telemetric monitoring in the management of patients with class I, II, and III indications for telemetric monitoring outside of critical care units. The class was assigned at the time of discharge for the purpose of the study. A total of 297 telemetry events were noted during the study, but only 12 (4%) of the events led to changes in patient management: a change in medication in 8 patients, cardioversion for unstable atrial flutter in 1 patient, insertion of a pacemaker for sinus pause in 1, and electrophysiology studies in 2 patients.

TABLE 3

Class III:
Cardiac monitoring is not indicated in patients...

At low risk after surgery

Without significant medical conditions during labor and delivery

With terminal illness who are not candidates for treatment of arrhythmias that might be detected

With chronic stable atrial fibrillation

With stable asymptomatic premature ventricular contractions or nonsustained ventricular tachycardia hospitalized for reasons other than cardiac or hemodynamic compromise

Who have underlying cardiac disease that has been stabilized and who have had no arrhythmias on 3 consecutive days of monitoring

BASED ON JAFFE AS, ATKINS JM, FIELD JM, ET AL. RECOMMENDED GUIDELINES FOR IN-HOSPITAL CARDIAC MONITORING OF ADULTS FOR DETECTION OF ARRHYTHMIA. J AM COLL CARDIOL 1991; 18:1431–1433, AND DREW BJ, CALIFF RM, FUNK M, ET AL. PRACTICE STANDARDS FOR ELECTROCARDIOGRAPHIC MONITORING IN HOSPITAL SETTINGS: AN AMERICAN HEART ASSOCIATION SCIENTIFIC STATEMENT FROM THE COUNCILS ON CARDIOVASCULAR NURSING, CLINICAL CARDIOLOGY, AND CARDIOVASCULAR DISEASE IN THE YOUNG: ENDORSED BY THE INTERNATIONAL SOCIETY OF COMPUTERIZED ELECTROCARDIOLOGY AND THE AMERICAN ASSOCIATION OF CRITICAL-CARE NURSES. CIRCULATION 2004; 110:2721–2746.

Estrada et al[8] examined the clinical outcomes of 2,240 patients admitted to a non-intensive care unit. The physicians perceived telemetric monitoring as helpful in 283 (12.6%) of the patients. However, data obtained from telemetry monitoring directly affected management decisions in only 156 patients (7% of the original study population). The researchers concluded that physicians may overestimate the role of telemetry in guiding patient management.

Hollander et al[9] examined the outcomes of 261 patients admitted because of chest pain who had normal or nonspecific findings on electrocardiography on presentation. Only 4 patients (1.5%) experienced arrhythmias. The authors concluded that the policy of admitting patients at low risk to monitored beds should be reevaluated.

Snider et al[10] showed that patients presenting with atypical chest pain and normal electrocardiographic findings were at low risk of arrhythmias and did not benefit from telemetric monitoring.

Schull and Redelmeier[11] performed a 5-year observational study in which they reviewed all telemetry admissions (N = 8,932) to a tertiary care facility. Twenty patients experienced cardiac arrest during the study period, but telemetric monitoring was in use at the time in only 16 of the 20. Furthermore, the telemetry monitors signalled the onset of cardiac arrest in only 9 of these 16 patients. Three of the patients whose hearts stopped beating survived until discharge: two in whom telemetry actually signalled the onset of cardiac arrest and one in whom it did not.

TELEMETRY CAN GIVE FALSE-POSITIVE ALARMS

Inappropriate use of telemetry creates a financial burden

Inappropriate use of telemetric monitoring increases the chance of artifacts or false-positive rhythms being misinterpreted as dysrhythmias and can potentially lead to errors in management.

Cases have been reported of patients undergoing invasive procedures because of artifacts seen during telemetric monitoring. Knight et al[12] described 12 patients who underwent unnecessary diagnostic or therapeutic interventions as a result of misdiagnosis of artifacts as ventricular tachycardia.

We did not discover in our review any data correlating the frequency of false-positive telemetric monitoring findings to management errors. On the other hand, it is also not possible to discern from these studies how often cardiac telemetric monitoring reaffirmed the clinical impression and facilitated ongoing therapy.

TELEMETRY IS EXPENSIVE

Telemetry requires specialized equipment and trained personnel, making it both costly and labor-intensive. The additional costs and cost-effectiveness of telemetry remain uncertain. Studies of its medical costs have found wide variations across different hospital systems. Sivaram et al,[7] in an observational study published in 1998, estimated the cost per patient at $683. At our hospital, the current cost of telemetric monitoring is at least $1,400 per patient per 24 hours.

Whatever the true cost, inappropriate use of telemetry creates a financial burden on the health care system and adds to unnecessary costs incurred by patients.

POTENTIAL BARRIERS TO APPROPRIATE USE OF TELEMETRY

A number of factors contribute to the inappropriate use of telemetry. Possible causes for its overuse may be a lack of awareness of the ACC and AHA guidelines, nonadherence to the guidelines, or a combination of factors.

Even when physicians are aware of these guidelines, adherence may be suboptimal for a variety of reasons (reviewed by Mehta[13]). Adams et al[14] revealed that most studies evaluating adherence were biased by overreporting, since the levels of adherence were self-reported.

OUR RECOMMENDATIONS

To improve on the appropriate use of telemetry, we recommend that several strategies be implemented.

Current guidelines for in-hospital cardiac monitoring need to be updated, particularly since the recommendations were based on evidence that is several decades old. Also, medical care has improved since the publication of the last guidelines, justifying an update in the guidelines.

Guidelines for cardiac monitoring should be incorporated into the curriculum for physician education to increase awareness of the guidelines. Hospitals should ensure that the emergency medicine staff is educated with regard to ensuring appropriateness of admissions to telemetry units.

Finally, the implementation of predictive models similar to that developed by Goldman et al[6] and implemented in the study by Durairaj[5] could help to ensure that cardiac telemetry is reserved for patients who will benefit from it the most.

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