

REVIEW

Cardiac Telemetry 2016: An Overview of Guidelines and Clinical Practice

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Abstract

The pervasive technology of cardiac monitoring has greatly advanced patient care for several decades. Since its advent, telemetry has been used in a variety of settings to guide medical management in patients who are either acutely or non-acutely ill. Evidence from several studies supports the benefits of the 2004 American Heart Association (AHA) telemetry guidelines in stratifying patients into 3 groups based on their individual cardiac event risk. It has been shown to reduce hospital costs without compromising patient care as well as eliminate overflow of telemetry units. This article reviews the AHA cardiac telemetry guidelines and evaluates the current status of its implementation, the general benefits, as well as its limitations.

Key words: Telemetry, Cardiac monitoring, Inpatient cardiac care.

Introduction

Cardiac telemetry, now a widely available technology, was first introduced into hospitals in the 1960's for the detection of life threatening arrhythmias. Its utility has since expanded to include ischemia surveillance as well as QT-interval monitoring (1). With the increasing number of elderly and critically ill patients, the utility of cardiac telemetry has increased in a manner that can often strain hospital resources and can create bottlenecks in the telemetry unit (2). Schull et al. argued the need for selective monitoring as patients did not significantly benefit from continuous routine cardiac monitoring (3). In efforts to improve efficiency of hospitals and to streamline unnecessary testing, the utility of cardiac telemetry has come into question. Hospitals often strive to balance cost without compromising patient safety and care, thereby creating the need for guidelines that are both needs-sensitive and cost-effective (4,5)

The American Heart Association Guidelines

In 2004, the American Heart Association (AHA) (6) re-established a risk stratification method, very similar to the 1991 ACC classification (7), aimed to identify patients that would benefit from cardiac telemetry. Three risk categories were described (Table 1).

Class I patients necessitate cardiac telemetry as these patients are at significant risk for life threatening arrhythmias which can lead to sudden cardiac death. In addition, class I also include patients in early phase of acute coronary syndrome to monitor for the risk of an MI (5), recently resuscitated cardiac arrest, recently administered of type I or type III antiarrhythmic drugs, indicated for intensive care due to acute heart failure/pulmonary edema, recently underwent cardiac procedures, who require cardiac procedures for device placement, and unstable arrhythmias such as AV block, Wolff-Parkinson White syndrome with rapid rate, and long-QT syndrome with ventricular arrhythmia. Class II category includes patients where cardiac monitoring may be indicated in certain instances. These include, but not limited to, patients with chest pain syndromes, more than 3 days after AMI, in stable condition after cardiac surgery, and unexplained syncope. The last category, class III patients are not indicated for cardiac telemetry but one condition includes rate-constant atrial fibrillation.

However, these criteria were constructed from expert opinion rather than actual study or evidence, so the question remains whether these classifications are sensitive and inclusive enough for most hospital settings.

Telemetry in Practice

Many studies have been done to confirm hospitals’

compliance with the AHA recommendations and to determine if these guidelines were inclusive enough for hospital implementation. A study showed that the hospital’s practices complemented the indications, making telemetry more efficient, however they noticed cardiac events in all 3 patients groups were relatively low. Broad guidelines may be a reason for the low incidence of events, suggesting a need to tailor the monitoring indications (8). Conversely, in a study conducted by Curry et al who reported that, in a community hospital setting, almost a third of patients on telemetry did not have appropriate indications and 17% of the patient cohort continued on past the 48 hour monitoring period (9). In addition, there are only time interval constraints on patients in classes I and II, specifically those who are admitted for management of acute myocardial infarction and for patients that present without persistent ST-segment elevation (10). Ivyone et al. noted in a study of 120 patients divided into the 3 AHA classes that the average length of stay in the telemetry unit was similar among each group (class I: 3.8 days, class II: 3.2 days, and class III: 3.8 days) (8). With class III patients having the lowest indication for telemetry, these data might indicate that guidelines may have to be adjusted to limit the proportion of class III patients admitted into telemetry as they have the lowest risk for a cardiac event (8). Without limits, the time interval is based on the medical staff’s discretion, which is based on a plethora of factors; defined intervals should be attributed to each condition, as it would reduce the burden of the medical staff to determine length of stay as well as standardize medical care. The PULSE trial, was a randomized clinical trial which was conducted in a 5 year period (2008-2013) at 17 hospitals across the country and analyzed hospitals’ adherence to the AHA guidelines. They noted a significant undermonitoring

Table 1. The rating system used in the 2004 AHA scientific statement ^a adopted from the American College of Cardiology Emergency Cardiac Care Committee ^b .	
Category	Indications for cardiac monitoring
Class I:	Cardiac monitoring is indicated in most, if not all, patients in this group.
Class II:	Cardiac monitoring may be of benefit in some patients but is not considered essential for all patients.
Class III:	Cardiac monitoring is not indicated because a patient’s risk of a serious event is so low that monitoring has no therapeutic benefit.

a. Drew et al. 2004
 b. Emergency Cardiac Care Committee members. Recommended guidelines for in-hospital cardiac monitoring of adults for detection of arrhythmia. J Am Coll Cardiol. 1991;18:1431–1433.

among sites for ischemia and QTc prolongation as it was more difficult to identify and required more hospital staff present, while they reported over monitoring especially for cardiac arrhythmias (11). It calls to question how closely these guidelines should be followed, and if physicians should be able to make decisions on which patients should be admitted based on their medical experience. Reducing the number of low-risk patients in cardiac telemetry has significant financial implications. In the study conducted by Benjamin et al., they concluded that based on the cost for a 400-bed hospital with a 35% decrease in cardiac telemetry (non-indicated patients), average savings were \$250,000 yearly, without compromising patient care (5).

Estrada et al. conducted the largest prospective study to date, in which he examined outcomes of 2240 eligible patients (based on the AHA guidelines) admitted to a non-intensive telemetry unit, to understand how useful cardiac monitoring was in guiding medical management. Physicians perceived telemetry to be useful in 12.6% of patients in this cohort, however data from the study showed that telemetry was useful but only altered medical care in 5.7% of patients while it identified acute arrhythmias that required an intensive care unit (ICU) transfer in 0.8% of patients (12). Overall, the study concluded that physicians overestimated the utility of cardiac telemetry of patients in non-intensive care units and it also provided data about management of chest pain syndromes.

Chest pain syndromes compose a majority of cases that present to the emergency department as they can pose a high risk for acute coronary syndromes. These patients are often sent to telemetry services to avoid the occurrence of acute arrhythmias; the data showed that telemetry changed management in less than 5% of patients admitted with syncope and chest pain syndromes (9). In addition, some studies have shown that patients presenting with chest pain and normal ECG readings do not benefit from telemetry monitoring as these patients have significantly fewer cardiac events and interventions ($p < 0.0001$) than patients with abnormal ECG readings (13). However, a cost-effective analysis of admission to telemetry of patients with low-risk chest pain proved that telemetry was more cost-effective than admitting patients to an unmonitored hospital bed when monitoring resources were available. It was most cost-effective when patients had a 3% change of developing acute ACS and patient's arrhythmias could be addressed promptly (14). This demonstrates the limitations of these guidelines; physicians should utilize their judgment

in admitting patients into telemetry as it was marginally useful and can strain hospital resources.

Expanding monitoring guidelines

While the AHA guidelines have benefitted hospitals through cost reduction as well as increased efficiency, we recognized several limitations to the monitoring indications and recommend the expansion of these guidelines to include other categories.

Sepsis

Severe septic patients have an increased risk for newly diagnosed atrial fibrillation, which can increase the risk for strokes, intensive care unit admission, acute organ dysfunction, and mechanical ventilation. Walkey et al. studied Medicare patients with a sepsis diagnosis and noted that 25% of these patients were diagnosed with atrial fibrillation. Age, the male gender, and the white race pose a substantial risk factor for newly diagnosed atrial fibrillation. With cardiac telemetry, acute atrial fibrillation can be detected early especially with high risk patients to reduce the incidence of in-hospital stroke and to reduce mortality (15). A recommended addition to the AHA indications would be to include monitoring at risk-septic patients for 24 hours during their period of diagnosis (16).

Alcohol withdrawal

Alcohol withdrawal is a common and very serious medical situation in which cardiac telemetry should be recommended. Minor symptoms corresponding to alcohol withdrawal include anxiety, anorexia, headaches, insomnia, and palpitations, however severe withdrawal can also be associated with myocardial ischemia and sudden cardiac death. (17). In a study conducted by Cuculi et al, 49 patients undergoing withdrawal were followed and 31 patients had long QT intervals, with 3 patients developing life threatening ventricular arrhythmias. Prolonged QT intervals are associated with an increased risk of torsades de pointes (18). Keeping patients undergoing severe withdrawal on telemetry would be important in monitoring these ECG changes to ensure that these patients seek an intervention immediately.

COPD

Fuso et al. studied the role that cardiac arrhythmias play in the mortality of acute exacerbation in patients with chronic obstructive pulmonary disease (COPD). COPD is becoming a more common diagnosis and acute exacerbations are often associated with sudden cardiac death. Data from

this study of 590 hospitalized COPD patients showed that 21% of patients had concurrent cardiac arrhythmias while 8% were in left ventricular failure. The most common morphology was atrial fibrillation and ventricular arrhythmias composing 41% of the arrhythmias, with 15% of the entire patient cohort having ST segment and T wave changes, which could indicate ischemia. With majority of patients on an anti-arrhythmic medication, cardiac telemetry seems to be required as acute exacerbation COPD patients are at high risk for developing arrhythmias. The study had a 14.4% mortality rate with the high risk factors being patients with ventricular arrhythmias (Odds ratio: 1.91) and atrial fibrillation (Odd ratio: 2.27) (19). However, it has been shown that short-acting beta agonists such as albuterol do not cause clinically significant arrhythmias (20). ECG analysis through cardiac telemetry could serve as an important short-term prognostic tool for COPD mortality as the heart greatly affects lung function. We recommend that physicians individually determine if COPD patients are at higher risk and if they should be placed on telemetry until their acute exacerbation dampens (16).

In practice, it may be a possibility that physicians are requesting telemetry for alternate reasons other than for cardiac concern. In a study conducted by Najafi et al., data showed that only 11 of out 182 patients that were admitted with cardiac telemetry could be categorized as Class I patients, while 50% of physicians indicated telemetry to detect clinical deterioration. This study emphasized that physicians may be using telemetry for other reasons that may not yield the most meaningful results, as telemetry had marginal effects on medical management (21). Brown et al. showed how with continuous respiratory and cardiac monitoring in the medical-surgical floor led to fewer code blue events and shorter stays at the ICU (22). While monitoring could be done in accordance with the indications, hospital staff may prolong the monitoring intervals by renewing orders to create a façade of security regarding the patients' health.

Conclusions

Cardiac telemetry is undoubtedly an essential aspect of patient care as it can detect early ECG abnormalities, which can prevent the conversion to life-threatening arrhythmias or SCD. Continuous respiratory and cardiac monitoring in the medical-surgical floor led to fewer code blue events and shorter stays at the ICU. However, continuous monitoring bears a heavy burden on hospitals and patients financially as telemetry beds cost at least \$200 more per night/per

patient. In addition, the increased number of telemetry monitors could cause alarm fatigue within the unit leading to desensitization. Cardiac monitors can present with a high false positive rate not only increasing the work burden but also leading to adverse hospital outcomes. The AHA classification stratifies patients based on indications for telemetry to ensure that resources are used most efficiently in the hospital. Studies have shown the utility of these indications, however some have questioned the inclusivity of these guidelines. Physicians should not have strict limitations for the rules of cardiac telemetry, as each patient case is unique. With continuous education, physicians should gather their own medical experience in addition to the AHA cardiac telemetry indications to guide medical management decisions.

Authors' Contributions

Both authors contributed significantly to the article and approved its final version.

Compliance with Ethical Standards

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