AbstrAct

• Objective: To determine patterns of telemetry use at a tertiary academic institution and identify factors contributing to noncompliance with guidelines regarding telemetry use.

• Methods: Web-based survey of 180 providers, including internal medicine residents and cardiovascular disease fellows, hospitalists, non-hospitalist teaching attending physicians, nurse practitioners, and physician assistants.

• Results: Of the 180 providers surveyed, 67 (37%) replied. Most providers (76%) were unaware of guidelines regarding appropriate telemetry use and 85% selected inappropriate diagnoses as warranting telemetry. Only 21% routinely discontinued the telemetry order within 48 hours.

• Conclusions: Many providers at a tertiary academic institution utilize continuous telemetry inappropriately and are unaware of telemetry guidelines. These findings should guide interventions to improve telemetry utilization.

For many decades, telemetry has been widely used in the management and monitoring of patients with possible acute coronary syndromes (ACS), arrhythmias, cardiac events, and strokes [1]. In addition, telemetry has often been used in other clinical scenarios with less rigorous data supporting its use [2–4]. As a result, in 2004 the American Heart Association (AHA) issued guidelines providing recommendations for best practices in hospital ECG monitoring. Indications for telemetry were classified into 3 diagnosis-driven groups: class I (indicated in all patients), class II (indicated in most patients, may be of benefit) and class III (not indicated, no therapeutic benefit) [2]. However, these recommendations have not been widely followed and telemetry is inappropriately used for many inpatients [5,6].

There are several reasons why clinicians fail to adhere to guidelines, including knowledge deficits, attitudes regarding the current guidelines, and institution-specific factors influencing practitioner behaviors [7]. In response to reports of widespread telemetry overuse, the Choosing Wisely Campaign of the American Board of Internal Medicine Foundation has championed judicious telemetry use, advocating evidence-based, protocol-driven telemetry management for patients not in intensive care units who do not meet guideline-based criteria for continuous telemetry [8].

In order to understand patterns of telemetry use at our academic institution and identify factors associated with this practice, we systematically analyzed telemetry use perceptions through provider surveys. We hypothesized that providers have misperceptions about appropriate use of telemetry and that this knowledge gap results in overuse of telemetry at our institution.

METHODS

Setting

Johns Hopkins Bayview Medical Center is a 400-bed academic medical center serving southeastern Baltimore. Providers included internal medicine residents and cardiovascular disease fellows who rotate to the medical center and Johns Hopkins Hospital, hospitalists, non-hospitalist teaching attending physicians, nurse practitioners (NPs), and physician assistants (PAs).

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Telemetry Utilization

Current Telemetry Practice
Remote telemetric monitoring is available in all adult, non-intensive care units of the hospital except for the psychiatry unit. However, the number of monitors are limited and it is not possible to monitor every patient if the wards are at capacity. Obstetrics uses its own unique cardiac monitoring system and thus was not included in the survey. Each monitor (IntelliVue, Philips Healthcare, Amsterdam, Netherlands) is attached to the patient using 5 lead wires, with electrocardiographic data transmitted to a monitoring station based in the progressive care unit, a cardiopulmonary step-down unit. Monitors can be ordered in one of 3 manners, as mandated by hospital policy:

1. Continuous telemetry – Telemetry monitoring is uninterrupted until discontinued by a provider.

2. Telemetry protocol – Within 12 hours of telemetry placement, a monitor technician generates a report, which is reviewed by the nurse caring for the patient. The nurse performs an electrocardiogram (ECG) if the patient meets pre-specified criteria for telemetry discontinuation, which includes the absence of arrhythmias, troponin elevations, chest pain, or hemodynamic instability. The repeat ECG is then read and signed by the provider. After these criteria are met, telemetry can be discontinued.

3. Stroke telemetry protocol – Telemetry is applied for 48 hours, mainly for detection of paroxysmal atrial fibrillation. Monitoring can be temporarily discontinued if the patient requires magnetic resonance imaging, which interferes with the telemetric monitors.

When entering any of the 3 possible telemetry orders in our computerized provider order entry system (Meditech, Westwood, MA), the ordering provider is required to indicate baseline rhythm, pacemaker presence, and desired heart rate warning parameters. Once the order is electronically signed, a monitor technician notes the order in a logbook and assigns the patient a telemeter, which is applied by the patient’s nurse.

If a monitored patient develops any predefined abnormal rhythm, audible alerts notify monitor technicians and an alert is sent to a portable telephone carried by the patient’s assigned nurse. Either the monitoring technician or the nurse then has the discretion to silence the alarm, note it in the chart, and/or contact the patient’s provider. If alerts are recorded, then a sample telemetry monitoring strip is saved into the patient’s paper medical chart.

Survey Instrument
After approval from the Johns Hopkins institutional review board, we queried providers who worked on the medicine and cardiology wards to assess the context and culture in which telemetry monitoring is used (see Appendix). The study was exempt from requiring informed consent. All staff had the option to decline study participation. We administered the survey using an online survey software program (SurveyMonkey, Palo Alto, CA), sending survey links via email to all internal medicine residents, cardiovascular disease fellows, internal medicine and cardiology teaching attending physicians, hospitalists, NPs, and PAs. Respondents completed the survey anonymously. To increase response rates, providers were sent a monthly reminder email. The survey was open from March 2014 to May 2014 for a total of 3 months.

Analysis
The survey data were compiled and analyzed using Microsoft Excel (Mac version 14.4; Microsoft, Redmond, WA). Variables are displayed as numbers and percentages, as appropriate.

RESULTS
Of the 180 invited providers, 67 replied, for a response rate of 37%. Residents were the largest group of respondents (42%), followed by non-hospitalist teaching attending physicians (31%), hospitalists (21%), fellows (4%), and one PA (1%) (Table). All providers reported having ordered telemetry, but almost all were either unaware of (76%) or only somewhat familiar with (21%) the AHA guidelines for appro-
appropriate telemetry use. Notably, the vast majority of fellows and residents reported that they were not at all familiar with the guidelines (100% and 96%, respectively). When asked why providers do not adhere to telemetry guidelines, lack of awareness of and lack of familiarity with the guidelines were the top 2 choices among respondents (Figure 1). Despite acknowledging unfamiliarity with the guidelines, 60% (40/67) felt their own ordering practices were consistent with the guidelines the majority of the time. The majority of respondents (64%, 43/67) felt that telemetry was not being appropriately utilized at their institution.

Additionally, most providers acknowledged experiencing adverse effects of telemetry: 86% (57/66) had experienced delayed patient transfers from the emergency department to inpatient floors due to telemetry unavailability and 97% (65/67) had experienced some delay in obtaining tests or studies for their telemetry-monitored patients. Despite acknowledging the potential consequences of telemetry use, only 21% (14/66) of providers routinely (i.e., > 75% of the time) discontinued telemetry within 48 hours. Fifteen percent (10/65) routinely allowed telemetry to continue until the time of patient discharge. When discontinued, it was mainly due to the provider’s decision (57%); however, respondents noted that nurses prompted telemetry discontinuation 28% of the time.

Finally, providers viewed a list of 14 diagnoses, only 3 of which met criteria for telemetry use per AHA guidelines—myocardial infarction/ACS, myocarditis, and ingestion of a cardiotoxic drug (Figure 2). Participants were asked to select the diagnoses for which they would order telemetry. Eighty-five percent (57/67) selected at least 1 inappropriate diagnosis. The most commonly selected inappropriate diagnoses in descending order were substance withdrawal (57%), gastrointestinal bleed (43%), pulmonary embolus with normal heart rate and blood pressure (37%), altered mental status (33%), acute renal failure with normal electrolytes (18%), and exacerbation of obstructive lung disease (12%). Seven respondents (10%) selected only the guideline-supported diagnoses.

The majority of providers (40/67) agreed that “better provider education” would be the most effective method for improving communication between providers and nurses regarding telemetry use. Rather than choosing one of the available answer choices (Figure 3), some providers offered write-in suggestions for improving communication about telemetry, especially with regard to limited telemeter availability. Examples included: “The biggest barrier to compliance with tele guidelines is that providers don’t know which of their patients are on tele; especially when taking over care from another
colleague.” Similarly, another provider wrote, “I wish… there was a prompt or sign that the patient is on tele… When we encounter tele shortages, I have to ask [the charge nurse] if there is any patient who no longer needs tele… We need to pay more attention.”

**DISCUSSION**

Consistent with previous studies [3–5,9–15], the majority of providers at our institution do not think continuous telemetry is appropriately utilized. Most survey respondents acknowledged a lack of awareness surrounding current guideline recommendations, which could explain why providers often do not follow them. Despite conceding their knowledge deficits, providers assumed their practice patterns for ordering telemetry were “appropriate” (ie, guideline-supported). This assertion may be incorrect as the majority of providers in our survey chose at least 1 non–guideline-supported indication for telemetry. Other studies have suggested additional reasons for inappropriate telemetry utilization. Providers may disagree with guideline recommendations, may assign lesser importance to guidelines when caring for an individual patient, or may fall victim to inertia (ie, not ordering telemetry appropriately simply because changing one’s practice pattern is difficult) [7].

In addition, the majority of our providers perceived telemetry overuse, which has been well-recognized nationwide [4]. While we did not assess this directly, other studies suggest that providers may overuse telemetry to provide a sense of reassurance when caring for a sick patient, since continuous telemetry is perceived to provide a higher level of care [6,15–17]. Unfortunately, no study has shown a benefit for continuous telemetry when placed for non-guideline-based diagnoses—whether for cardiac or non-cardiac diagnoses [3,9–11,13,14]. Likewise, the guidelines suggest that telemetry use should be time-limited, since the majority of benefit is accrued in the first 48 hours. Beyond that time, no study has shown a clear benefit to continuous telemetry [2]. Therefore, telemetry overuse may lead to unnecessarily increased costs without added benefits [3,9–11,13–15,18].

Our conclusions are tempered by the nature of our survey data. We recognize that our survey has not been previously validated. In addition, our response rates were low. This low sample size may lead to under-representation of diverse ideas. Also, our survey results may not be generalizable, since our study was conducted at a single academic hospital. Our institution’s telemetry ordering culture may differ from others, therefore making our results less applicable to other centers.
Despite these limitations, our results aid in understanding attitudes that surround the use of continuous telemetry, which can shape formal educational interventions to encourage appropriate guideline-based telemetry use. Since our providers agree on the need for more education about the guidelines, components such as online modules or in-person lecture educational sessions, newsletters, email communications, and incorporation of AHA guidelines into the institution’s automated computer order entry system could be utilized [17]. Didactic interventions could be designed especially for trainees given their overall lack of familiarity with the guidelines. Another potential intervention could include supplying providers with publically shared personalized measures of their own practices, since providers benefit from reinforcement and individualized feedback on appropriate utilization practices [19]. Previous studies have suggested that a multidisciplinary approach to patient care leads to positive outcomes [20,21], and in our experience, nursing input is absolutely critical in outlining potential problems and in developing solutions. Our findings suggest that nurses could play an active role in alerting providers when patients have telemetry in use and identifying patients who may no longer need it.

In summary, we have shown that many providers at a tertiary academic institution utilized continuous telemetry inappropriately, and were unaware of guidelines surrounding telemetry use. Future interventions aimed at educating providers, encouraging dialogue between staff, and enabling guideline-supported utilization may increase appropriate telemetry use leading to lower cost and improved quality of patient care.

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References

TELEMETRY UTILIZATION


Appendix. Provider Survey
1. Have you ever ordered telemetry for your patients?
   a. YES
   b. NO
2. Please select the following diagnoses for which YOU WOULD order continuous telemetry monitoring. Select all that apply.
   - GI bleed
   - Malignancy
   - Ingestion of a drug known to cause cardiotoxicity
   - SIRS/Sepsis without septic shock
   - Acute renal failure (electrolytes normal)
   - Sickle cell crisis
   - PE with normal heart rate and blood pressure
   - Acute MI or ACS
   - Exacerbation of obstructive lung disease
   - Pneumonia
   - Substance Withdrawal
   - Altered Mental Status
   - Myocarditis
   - Risk of elopement
3. How familiar are you with how Bayview’s different orders for telemetry (continuous and protocol) are supposed to be used?
   a. Very familiar
   b. Somewhat familiar
   c. Not at all familiar
Appendix. (continued)

4. How familiar are you with the American Heart Association telemetry guidelines?
   a. Very familiar
   b. Somewhat familiar
   c. Not at all familiar

5. What are the top 2 reasons why your peers would not be in compliance with telemetry guidelines from the American Heart Association (AHA)?
   • Unaware that guidelines exist
   • Unfamiliar with the details of the guidelines
   • Don’t agree with them
   • Don’t think they apply to patients for whom they were to order telemetry
   • Don’t think the guidelines are very important
   • Difficulty in changing previous practice behavior
   • Barriers (time, limited resources, or other restrictions) exist that prevent compliance with guidelines
   • Other: _______

6. Guidelines from AHA suggest that in most conditions, telemetry can be discontinued within 24-48 hours of patient monitoring. How often do you think you discontinue or advocate for discontinuing telemetry within 24 – 48 hours of monitoring?
   a. Less than 25% of the time
   b. 25-50% of the time
   c. 50-75% of the time
   d. Greater than 75%

7. When you order telemetry, how often do you think the indication meets those approved by guidelines (if you do not know the guidelines, just guess)
   a. Less than 25% of the time
   b. 25-50% of the time
   c. 50-75% of the time
   d. Greater than 75%
   e. I don’t know

8. Of patients under your care how often do you discontinue telemetry within 48 hours of starting it?
   a. Less than 25% of the time
   b. 25-50% of the time
   c. 50-75% of the time
   d. Greater than 75%

9. How often are you asked by nursing to discontinue telemetry?
   a. Very often
   b. Sometimes
   c. Rarely
   d. This has never happened to me

10. How often do you discuss discontinuation of telemetry on work rounds or other clinical discussions with your team?
    a. Often
    b. Rarely
    c. Never
    d. I don’t work on a team

11. How is telemetry most often discontinued for your patients?
    a. I choose to discontinue it on my own
    b. A nurse asks me to discontinue it
    c. A colleague discontinues it for me
    d. A nurse discontinues it per protocol
    e. It is discontinued when the patient is discharged
    f. Other (specify: _______________)

TELEMETRY UTILIZATION

Appendix. (continued)

12. Do you feel that telemetry is appropriately utilized?
   a. YES
   b. NO

13. How comfortable are you when nurses talk to you about telemetry use and discontinuation?
   a. Very
   b. Somewhat
   c. Not at all

14. Which of the following might improve the dialogue between providers and nurses about telemetry use?
   a. Better nursing education
   b. Better provider education
   c. Improved provider/nurse relationship
   d. Other:________

15. Have you ever had a patient who could not come to the floor because there were no telemeters available?
   a. Often
   b. Rarely
   c. Never

16. Have you ever had a patient who could not leave the floor because of telemetry (e.g., x-ray or other diagnostic test)?
   a. Often
   b. Rarely
   c. Never

17. Please select the role that best describes you:
   a. Housestaff
   b. Fellow
   c. Teaching attending (other than hospitalist)
   d. Hospitalist physician
   e. Physician assistant
   f. Nurse practitioner

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