



Body Surface Mapping

An 80 Lead Electrocardiogram Detecting Acute MI's Missed With Traditional 12 Lead ECG

Body surface mapping (BSM), a new technology using eighty leads placed on both the front and back of the patient's chest wall, can detect myocardial infarctions that are sometimes difficult to diagnose by the traditional twelve lead ECG. Body surface mapping expands on the concept of the twelve lead and adds enhanced imaging to visualize the areas of ischemia or infarction. BSM attempts to overcome the limitations of the twelve lead ECG that can result in a delayed diagnosis or undiagnosed situations.

A twelve lead ECG provides an adequate recording of electrical activity on the anterior, lateral and inferior surfaces of the heart but does not provide for concise information about the posterior wall. In addition, patients who present with non-classic symptoms or new left bundle branch block on their ECG may not be quickly identified as having an acute infarction. Thus, acute MI patients who present to the emergency department with a new left bundle branch block, infarcts of the posterior wall as well as those who are symptomatic but have borderline changes on their twelve lead, may have delays in definitive treatment pending a diagnosis



PRIME ECG electrode vest being applied

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confirmed by other diagnostics such as biomarkers, echocardiography, nuclear imaging or cardiac catheterization. Approximately one-third of MI patients present atypically with no chest pain and may have inconclusive ECG's. These atypical patient presentations often include women, non-whites and diabetics.

Body surface mapping, using significantly more leads placed on both the anterior and posterior chest wall, results in a more comprehensive visualization and interpretation of electrical activity of the heart. A disposable "vest" comprised of strips of plastic with adhesive gel pads at each lead site (64 on the anterior surface and 16 on the posterior surface) is placed on the patient. The information from the leads is channeled into a single cable that connects to the computer/software that performs the imaging.

The software with the system produces displays not only of the electrical tracings, but also provides three dimensional torso images identifying areas of ST elevation (displayed in red coloration on the images) and ST depression (displayed in blue coloration). When a cursor is placed over areas of elevation or depression on the image, the corresponding lead and sample beat are displayed to correlate the electrocardiography tracing with the image. Although the system has algorithms to identify other conditions such as early repolarization and left ventricular hypertrophy, the system's primary use is seen as being a quick and efficient way to diagnose ST elevation myocardial infarctions in the Emergency Department, so that treatment decisions can be instituted promptly.

While this technology is just emerging for more general use, the Center for Medicare/Medicare Services (CMS) has assigned billing codes for this service. These codes include:

- **0178T** - Electrocardiogram, 64 leads or greater with graphic presentation and with analysis, interpretation and report
- **0179T** - Electrocardiogram, 64 leads or greater,

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A Message From the President

Smile, you are on CTA camera!



Barb Sallo

CT scan owners breathed a sigh of relief on March 12, 2008 when Medicare said that it would continue to cover the use of computerized tomography angiography (CTA) to detect heart disease. CMS had some misgiving over whether there was sufficient evidence to justify paying for the tests and in the proposed national coverage determination, was going to limit payment except for clinical trials.

Reversing the proposed decision that was issued last December, Medicare reported that it would continue to leave payments for the scans to the discretion of the local insurance carriers that the agency employs to oversee medical claims. Most local carriers have been covering the test. The fee for CTA ranges from \$600 to \$1,000. Medicare paid for about 70,000 coronary scans in 2006 at a cost of \$40 million to \$50 million.

With this “good news” or reprieve, the growth of CTA as a valuable diagnostic tool is expected to continue at the same or faster pace than previously seen. The American College of Cardiology (ACC) leadership expects CTA use to reduce the number of unnecessary cardiac catheterizations, estimated at as many as 40%--per the registry.

Another interesting twist in the 2008 bill extending funding from Medicare, was the removal of the provision that would have required imaging professionals and centers to become accredited by an established radiology association in order to remain eligible for Medicare reimbursement. Even without this accreditation requirement,

CMS is setting the tone for future trends in this area.

Some insurers are mandating accreditation of imaging providers in order to qualify for reimbursement by their plans. Other “cost cutting” and quality initiatives include the use of radiology benefits-management company programs to educate physicians regarding the appropriate use of the high-tech scans and programs informing primary care doctors when their patients approach significant levels of radiation exposure (usually from repeat/multiple testing).

A *New England Journal of Medicine* article in November, 2007 reported researchers from Columbia University estimated that 2 percent of future cancer cases could be linked to radiation from CT scans. The American College of Emergency Physicians and the American College of Radiology have criticized this report but also find merit in the study’s suggestion that CT usage be reviewed.

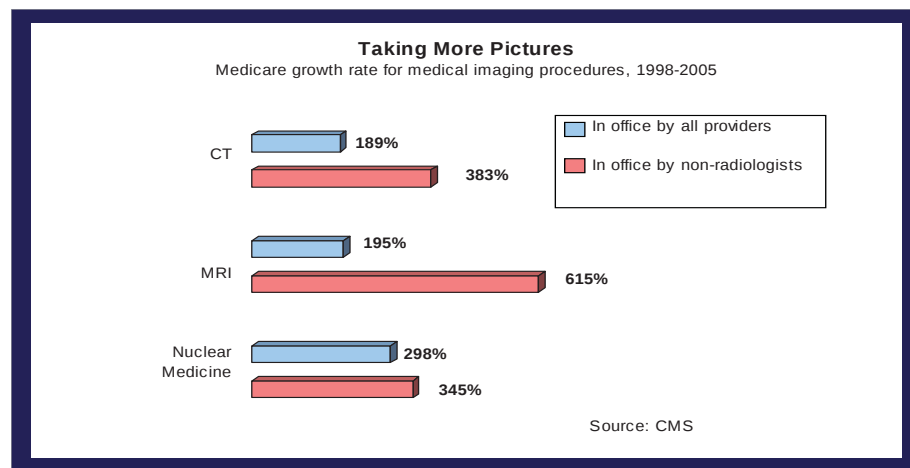
The paper had three suggestions for reducing radiation exposure: lowering the CT-related dose for each individual, replacing CT with other imaging options when practical and decreasing the number of CT studies prescribed per patient.

All of the above are good areas for hospitals to routinely work with radiologists to improve CT protocols. The number of administered scans grew from 20 million in 1995 to 63 million in 2005, according to researchers at the Yale School of Medicine.

How should hospitals respond? Some of the following actions are becoming routine:

- modifying the electronic medical record system to show how often a patient receives radiation
- taking steps to curb radiation exposure through education programs for practitioners and patients with lectures and print materials
- tightening protocols with multi-discipline reviews
- logging the radiation dose administered in every scan with a review for any outliers

The “take away” from the recent reports and events indicates that if providers do not institute self credentialing, use evidence-based guidelines for imaging referrals and monitor the long-term effects of radiation exposure on patients, the payors will be glad to mandate these or withhold payment.



Sudden Cardiac Death

... and Microvolt T-Wave Alternans Testing



Rose Czarnecki

Sudden cardiac death, according to the American Heart Association, is death resulting from an abrupt loss of heart

function (cardiac arrest). The time and mode of death are unexpected and occurs within minutes of the onset of symptoms. The most common underlying reasons are coronary heart disease and recent myocardial infarction (within 4 to 6 months). Other risk factors for sudden cardiac death may include decreased ejection fraction, structural heart disease, prior episodes of sudden cardiac arrest, family history or a genetic defect related to cardiac conduction.

Sudden cardiac death is one of the leading causes of death in the United States accounting for about 350,000 deaths per year; it is responsible for half of all heart disease deaths. Sudden death occurs most frequently in adults in their mid-30s to mid-40s, and affects men twice as often as it does women and is rare in children.

Symptoms include a rapid heart rate and the patient may complain of feeling dizzy or faint, however, some have no prior symptoms. The most common cause is tachyarrhythmias such as ventricular fibrillation or tachycardia.

With limited ability to prevent

sudden cardiac death, prevention may depend upon risk prediction. Patients identified as being at risk usually undergo several diagnostic tests to determine if they are at jeopardy for tachyarrhythmias that can progress to sudden death. Diagnostic testing may include repeated electrocardiograms, echocardiogram, cardiac catheterization and/or electrophysiologic studies.

An additional approach to assessing sudden cardiac death risk is Microvolt T-Wave Alternans Testing. T-wave alternans is a type of electrical alternans where there is a beat to beat variation in the morphology of the T-wave pattern. Its presence has been linked to ventricular arrhythmias and sudden cardiac death. T-wave alternans is generally subtle, with the variation in electrical amplitude being within a few microvolts; therefore, T-wave alternans is generally undetectable on a standard ECG, but can be detected by elaborate signal processing techniques. There are several systems currently on the market such as the HearTwave® II Microvolt T-Wave Alternans system.

Microvolt T-Wave Alternans is highly rate dependent; therefore, testing involves elevating the patient's heart rate by exercise stress, pharmacologic stress or cardiac pacing. Elevation of the heart rate increases the sensitivity of Microvolt T-Wave Alternans testing.

Microvolt T-Wave Alternans testing can be performed in a number of settings, including

physician's offices, stress and echocardiography labs or pacemaker/device labs and clinics. Patient preparation is the same as for an exercise stress test. Sensors are applied to the chest and back and connected to the testing equipment. The patient walks on a treadmill for about 6 to 8 minutes to increase their heart rate. Usually information is obtained when the patient is at rest and exercising.

Microvolt T-wave alternans testing is reported with CPT code 93025—microvolt t-wave alternans for assessment of ventricular arrhythmias. Under CMS



National Coverage Determination 20.30, microvolt T-wave alternans testing is covered by Medicare for evaluation of patients at risk for sudden cardiac death. The testing is covered by Medicare only if the testing equipment utilizes the spectral analysis method (measures alternans at the level of one microvolt) for calculating EKG voltage changes. Some non-Medicare payors may consider T-wave alternans testing to be investigational and therefore may not provide coverage.

Under the CCI edits, EKG (3000-93010), rhythm strip (93040-93042) and stress test (93015-93017) are components of T-wave alternans testing and should not be charged separately.

Whose Cath Lab is it Anyway Part V

This installment of “Whose Cath Lab is it Anyway?” will address one of the two remaining areas identified in the original article. The topics of multiple physician specialties in a shared lab space, staffing, staff mix, use of extenders, inventory management, staff education, training and competencies have been addressed in previous segments. We will now turn our attention to case scheduling to accommodate multiple disciplines and case types.



Marsha Knapik

All cardiac catheterization laboratories use some “system” to schedule patient cases. The challenge is to find a system that meets the needs of the physicians, optimizes use of the procedure room(s) and accommodates “add-on” last minute and emergency cases. There is no one perfect system but there are some scheduling methods that can be of value and certainly can be tailored to meet the lab’s clinical and operational needs. First, the lab director must look at his/her current system and evaluate how well it does or does not meet the needs of the physicians and the department. If your current system is working for you, stick with it; but realize as technology changes (which can mean cases take longer or move more quickly) or as additional physicians and physician specialties are added to your lab roster, you may need to periodically re-evaluate how well the lab’s current scheduling method continues to meet needs.

Many labs have a “first-come, first serve” system of scheduling where cases are added as the lab is notified of them. This allows the schedule for the procedure room to be filled with no “open” slots



or “holes” in the day. Thus, there is little or no down time in the middle of the day. A benefit of this scheduling system is

that all physicians have equal opportunity to get their cases onto the schedule as well as the possibility for the preferred morning time slots. This system also allows any physician to put as many cases on the schedule as he/she wants on any given day until such point as the schedule is full. A possible downside to this system is that one physician may have the first case and the third case, while a different physician may have the second case. This means that the first physician upon completion of his/her first case, will potentially leave the lab to either see patients/consults or to go “read” other diagnostics, etc. There may be time delays in the cases waiting for the second physician to arrive (as he/she may be in the middle of rounds or a consult) and then another delay in getting the first physician to return to the lab.

When physicians leave the lab and get involved in other hospital duties it is often a challenge to have them return to the lab later. This system (as with all scheduling systems) must also allow for cases to be “bumped” back to accommodate emergencies. Thus, an emergency case may impact or delay cases

from several physicians rather than one physician or physician group (as would occur with block or modified block scheduling). If physicians have placed cases on the schedule with the intention of having those cases completed prior to office hours in the afternoon, the bumping of their cases may result in either the cancellation and rescheduling of cases (electives) or the physician may have to reschedule or delay patients in his office. The first come, first serve system works well for lower volume programs, single labs, or labs with only one or two physicians or physician groups.

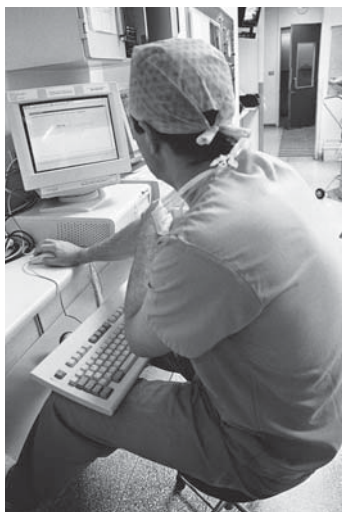
Block scheduling is a system that is often used for higher volume labs, multiple labs or labs that have multiple types of specialists performing procedures in the lab (ie: cardiologists, interventional radiologists, vascular surgeons, etc.). Block scheduling assigns blocks of time (several hours) to individual physicians or physician groups who then schedule their cases within that time frame. Thus each physician knows how many cases he/she can schedule and exactly what time each day he/she or members of their group will have access to the lab. For example: Dr. Smith and his group may have 8-12 noon on Monday, Wednesday and Friday, while Dr. Jones may have 12-4pm on those days. The time blocks could be reversed on Tuesday and Thursday with Dr. Jones having the morning block of time and Dr. Smith having the afternoon block. This allows the physicians to more predictably schedule cases in regard to other time commitments (rounds, office hours, etc.). The negative aspect of this from the physician perspective is that there

Whose Cath Lab is it Anyway Part IV (con't)

is less flexibility because there is a limit as to the number of cases he/she may schedule (can only fill his/her block of time). Most labs that use block scheduling have provisions that allow physicians to negotiate among themselves to trade selected time slots on a day to day basis to accommodate changes in needs. These trades should be negotiated between the physicians directly and not left to the cath lab staff or the cath lab director to have to “negotiate” trading of time slots. Labs generally have a policy outlining cut off times for scheduling cases for the next day so that any unfilled slots can be given away to any physician who wants to add a case. Empty time slots can be used to accommodate physicians who on any given day may have an increased caseload.

Modified block scheduling is very similar to strict block scheduling except each day a small block of time (or two or three single time slots) is considered “open” and can be scheduled by any physician or physician group. This allows for the predictability of each group time slots to accommodate their caseload, but adds some flexibility to the schedule so that low volume physicians who only do an occasional case have slots available. The open slots also allows physicians who have a higher than normal caseload on any given day to be able to perform cases in addition to their “normal” block of cases. Either type of block scheduling system will also need to accommodate emergency cases that may cause any physician’s scheduled cases to be delayed. All cases are usually pushed back in order on the schedule, thus cases in each block of time will be delayed also. The physician(s) with those

later cases should be notified that their block of time has been pushed back by an emergency case. Block or modified block scheduling is considered to be more efficient



in accommodating cases than “first come first serve”, however, there has been a slow transition to block scheduling as it requires considerable effort to implement. The initial step for implementing a block schedule is for the cath lab manager or director to examine caseload of all physicians who practice in the lab. The days and blocks of time allotted to each physician on a regular basis should be determined initially by their “usual” caseload. Thus, higher volume physicians would be given more days and larger blocks of time. Once it is determined how much time each physician or physician group is to have, there should be discussions with each group to determine preferences for morning or afternoon slots, what days of the week they prefer, their current office hours (so their block time in not is conflict). Needless to say, coming up with an initial block schedule that is agreeable to all parties involved can be difficult. Any attempt to move to a block type scheduling system should

be discussed with all physicians prior to making the commitment and the manager/director of the lab needs to be supported and assisted in this process by the Medical Director. An important aspect of implementing the block schedule is that once initiated, it should be evaluated soon after implementation to determine that it is meeting each physician’s needs and any adjustments to a physician’s days or blocks of time are made in a timely manner. Thus, the initial block schedule will most likely need adjusted several times until a workable schedule is in place. As with any scheduling system, it must be re-evaluated periodically and will need adjusted when any consistent caseload changes occur within a group or if a new physician/group is added to the cath lab roster.

In addition to types of case scheduling, there is the issue of how much time should be allotted on the schedule for each case (or case type). Many labs schedule cases hourly regardless of the type of case (diagnostic, cardiac intervention, peripheral intervention). For some this is workable if the lab has lower volume with time to expand if cases take longer or if you have fewer physicians whom you can reliably predict the amount of time they will take per case type. Other facilities allocate a specified amount of time for each case type: i.e. 60 minutes for a diagnostic cath (regardless of LHC, RHC, or combined Rt and LHC), 90 minutes for an interventional procedure and 90 minutes for a peripheral interventional procedure, etc. Cases are added to the schedule allowing the appropriate amount of time for each case type. Facilities that schedule cases with the time

Whose Cath Lab is it Anyway Part IV (con't)

element may also have a policy that requires physicians to notify the lab if they have a case they feel is particularly complex (multi-vessel or multi-lesion) so that additional time can be allotted. The advantage to scheduling with a time element added is that it assists in minimizing delays of the cases following that procedure. Scheduling can be more realistic, in terms of accommodating

patients and physician groups with fewer instances of delay. As we are all well aware, even with scheduling for longer, more complex cases, there will be times that cases run more quickly than anticipated as well as those that take longer than the scheduled time.

While this article provides only a brief discussion of scheduling, you can see there are several factors to

consider and several options to use in scheduling cases into the cardiac catheterization laboratory. It is imperative that the scheduling system be periodically reviewed to determine if it is meeting the needs of the lab and the physicians. Changes to any scheduling system requires the support of the Medical Director, hospital administration and input from all the physicians requiring lab time.

More than 5 million Americans have heart failure and about one percent of people age 65 and older start having heart failure annually.

--American Heart Assn.

Body Surface Mapping (Con't)

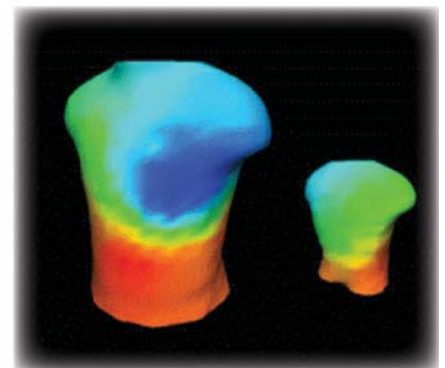
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tracing and graphics only
0189T - Electrocardiogram,
64 leads or greater,
interpretation and report only

It is important to note that reimbursement is not necessarily guaranteed for this diagnostic test and providers should check with their intermediaries to investigate reimbursement options prior to service implementation. This test is currently considered "investigational/not medically necessary" by many commercial payers.

While this diagnostic test is considered investigational, the initial studies conducted indicate it is a reliable diagnostic tool that can readily identify patients who would have had undetected disease or had a delay in care. Use of additional leads (especially the incorporation of posterior leads) with the addition of three dimensional computer imaging would appear a logical next step in electrocardiography imaging. Additional experience and testing with this system in the next few years should determine if reimbursement will be firmly established and how well the technology will be embraced

in Emergency Department care of the acute cardiac patient.



Close Up of Torso Image with Inferior MI

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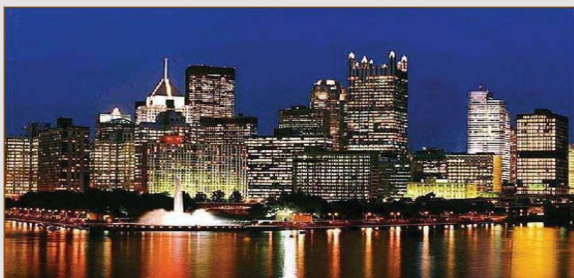
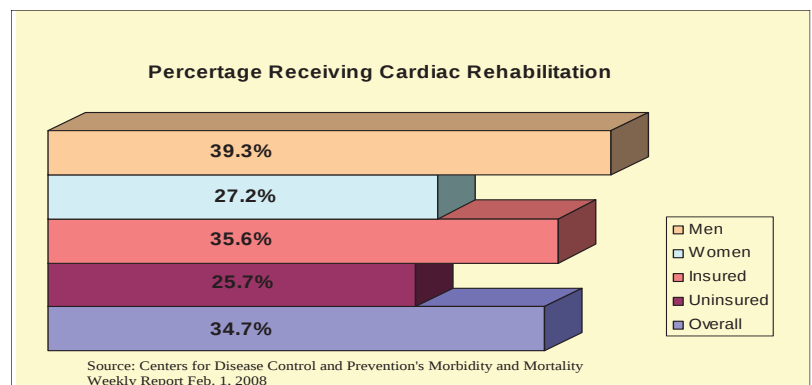
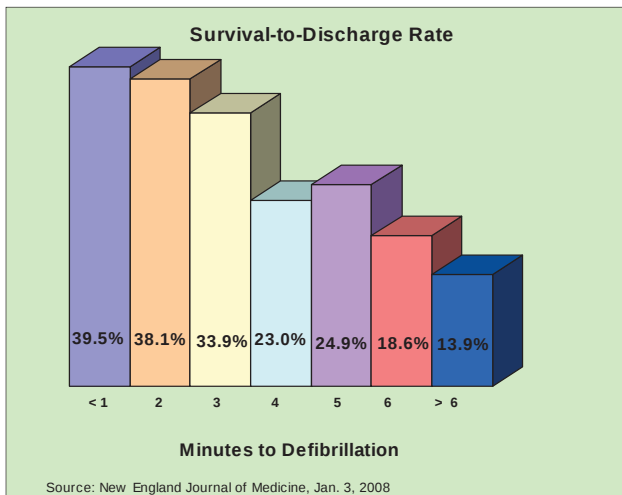
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