As a biomedical equipment technician (BMET), why should I care about electrocardiogram (ECG) lead placement and patches?

We care because ECG lead placement and patches affect how equipment is perceived to be running or not running. Very simply, the placement and condition of patches affects us as BMETs immensely. On countless occasions, I have been called because a monitor won’t read any ECG rhythm, only to find out that the leads and patches had been on the patient for 48 hours. Most monitoring companies cover this in the in-servicing of the monitors when they are new, but staff may still think that the monitor is at fault.

When properly attached, ECG electrodes will reduce the electrical resistance of the patient’s skin, from approximately 10,000 Ω to about 500 Ω. If this step is overlooked, it can cause the nurse a lot of unneeded havoc. Here are some simple steps to go over with staff to determine whether you should be suspicious of bad lead attachment:

1. Was the skin cleaned with soap and water or alcohol to clear the skin of oil and dirt?
2. Was the skin dried after being cleaned?
3. Were the electrodes used new? This should ensure that they are moist.
4. Were the patches firmly placed on the skin? Some companies include a pad feature that lightly scratches the surface of the skin to ensure tight placement.
5. Was the lead set secured to prevent wandering baselines? Tape can be used for this. Some companies include a clip on the cable, which enables it to be secured to bed sheets.

Next, we need to be aware of lead placement. As a BMET, sometimes you will need to look at the patient to troubleshoot a device. Start by checking the limb leads (LA, RA, and LL, which refer to left arm, right arm, and left leg, respectively), being particularly watchful for electrodes and leads placed over pacemakers and bone. Pacemakers will cause excessive noise on some monitors and “spikes” on others. Bone is dense and will disrupt the electrical conduction. Sometimes, the LA lead will need to be placed on the back of patients with pacemakers in order to eliminate spikes.

For basic placement of leads, remember Einthoven’s triangle, which says that lead I and lead II should equal lead III. Lead I is RA to RA, lead II is RA to LL, and then lead III will be LA to LL, thereby providing medical staff three different views of the heart. More
views of the heart are available through use of augmented vector leads (aVR, aVL, and aVF, which refer to augmented vector right, left, and foot, respectively) and Einthoven’s triangle. For 12-lead ECG machines, chest leads (V1 through V6) provide even more views of the heart.

Augmented leads read a view between the basic I, II, and III leads. aVR is an amplification of the ECG signal between the RA lead and half the sum of the potential between the LA and LL leads. aVL is an amplification of the ECG signal from the LA lead and half the potential between the RA and LL leads. Likewise, aVF is the amplification of the ECG signal between the LA leads and half the sum of the potential between the RA and LA leads.

In summary, effective skin preparation, lead placement, and lead view related to ECG monitoring are essential aspects of a BMET’s daily work. Having a sound grasp of this basic knowledge allows BMETs to effectively investigate problems that might arise with a monitoring, stress test, or 12-lead ECG system. The more tools we have at our disposal, the more quickly and confidently we can troubleshoot problems.