Operating Room (OR) Tech Tips
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Make sure you have all the correct ends together prior to doing this. I laid all my cords out on the living room floor and visualized how I was going to hook up one end of the wires to my monitoring equipment; for example, the stimulator plug into the base, the pod ends that plug into the amplifier then the other end would be the pods, and the stimulator box going to the OR table (Figures 2 and 3).

Allow extra cord at each end to compensate for the length needed to plug into the equipment base and amplifier as well as the length you may need to run your pod cables down the length of the OR table allowing you to plug your leads from the patient into the pods and stimulator box. You do not want the leads coming from the patient to be tight or stretched. This will cause you more problems further into the case involving a lot of crawling under the table and troubleshooting.

If you or your company do not chose to spend the money to purchase the “cable zipper” then I have seen technologists gather the cords running from the machine to the OR table and tape the cords altogether along the floor or after gathering them the technologist covers them with a blanket. No matter what technique of gathering your cables you decide to use, the sole purpose is to eliminate the noise and interference your equipment may pick up on in the OR room.

As for the pods there are A, B, C, and D. I placed color sticker dots on my amplifier and pods to match while I laid them out on the floor to put the cable zipper around them. I have found this works best for me personally (Figures 4, 5A, and 5B). I know the first pod A has a yellow sticker because it’s for my single leads which are recording leads that I insert in the
patient’s scalp. I remember this because the sun is always up top and the head is on top of the body. The next one is B and its green and the two pods C and D that are set up in my programs to be at the patient’s lower extremities are blue and red. The C pod is blue at is for the patient’s left side and D pod is red for the patient’s right side; that is my EEG experience coming out.

![Image](image1.png)

**FIG 4.** Color sticker dots on amplifier cables.

![Image](image2.png)

**FIG 5A and 5B.** Color sticker dots on pods in place at foot of table and at head of table.

An experienced IONM technologist explained to me that her company has the supplies they use organized in a labeled container ready to go. For example, the employee pulls the box labeled “Lumbar” and it has everything in it needed for that particular type of case. I have adopted this method into my routine. When I receive my supplies I sort out and gather what I need for each particular type of case that I cover routinely. I gather it all into one of the supply boxes and write on the front of the box with a sharpie marker “Lumbar” or “Cervical with MEPs” for instance. I stack them on my shelf (Figure 6). This way when I get called for a case at the last minute, which happens to all of us, all I have to do is grab that labeled box and I know it has everything in it I am going to need. I can get going on my way as soon as possible.
The next issue is leads. I can utilize up to several leads, 32 to be exact for my equipment plus a ground, because each of the four pods have eight plug-ins marked 1 through 8. I use subdermal leads and insert them into the patient in the appropriate areas of the body. These leads need to be plugged into either pods or the amplifier box whatever your particular equipment calls for. I’m familiar with single leads and paired leads. Whether the pairs are twisted or not is company or technologist preference. The leads come in a variety of colors. There are a lot of ways to simplify this so it is not as confusing as when you are first learning, pressed for time, or while fumbling to plug in leads plus trying to remember “which lead was in which muscle and now where do I plug it in?” I know firsthand how stressful this can be. It wasn’t that long ago for me. I particularly would get very confused. One technologist taught me, white on right. So the paired leads I use come with a color paired with a black and a color paired with a white. White on right works for me, to remember all my white and colored paired leads are on the patient’s right side. This means all the colored and black paired leads are on the patient’s left side (Figure 7).
I start from top to bottom whether it’s a cervical case or a lumbar case. The technologist training me told me to use the color scheme of a traffic light. When I was having trouble, another technologist told me to use red and green first for Christmas colors and then my school colors next which were blue and yellow. That worked for me but then what if I needed more than four colors? Another technologist stated she uses the patriotic colors red, white, and blue. I could remember that and then added my school colors in after the red, white, and blue motto. For example, if I have a lumbar case and am utilizing the lower extremity muscles of adductor magnus (AM), vastus lateralis (VL), tibialis anterior (TA), medial gastrocnemius (MG), and hallucis longus (HL) then I am inserting my leads in order starting at the top and remembering white on right. AM is red, VL is blue, TA is yellow (red and blue for patriotic and then yellow because blue and yellow were my school colors), then MG is green, and HL is orange. Only because my lead color options are red, blue, yellow, green, and orange in each box. After doing this repeatedly, I promise it gets easier to remember even though you may not think so at the time. These leads are then plugged into the pods in order because that is how it is set up in my machine.

When plugging in; a few simple tricks can be utilized such as a piece of tape on the pod with the prewritten numbers for that particular montage you will be using in the case. In a pinch I have written the order on my hand or a piece of tape and stuck it on my leg. I have even written it all out on a pocket size piece of paper and put it in my pocket in case I felt I needed something to glance at for a brief second. When I first started monitoring in the OR I was so nervous I would prepare the night before, sometimes writing on the back of each of my lead packages what muscle it was for because there are a lot of leads involved for cervical cases with MEPs. You can’t even imagine how many times being nervous I would drop my packages from my pocket and while scooping them back up in haste trying not to miss a beat I would get them out of order and then be stumbling trying to figure out which color I needed next so as not to get confused.
when it came time to plug them all in. I would also arrive to my case extra early, sometimes a half hour earlier than required. I would go over it all in my head or go through my notes.

If I am doing a cervical case, I utilize the muscles of trapezius (Trap), deltoid (Delt), biceps (Bi), triceps (Tri), flexor carpi ulnaris (FCU), and abductor pollicis brevis (APB). Now you may say but that’s more than five muscles like the lumbar stated previously. Yes, and the machine inputs are limited also so the color scheme I utilize is trapezius is red, deltoid is blue, and biceps/triceps are together so they are yellow. I always remember the color yellow lead is in biceps because B is first in the alphabet and then the black or white lead paired with the yellow is in triceps (and remember white is on right). FCU is orange and APB is green. Did you catch I switched those colors around? It’s because as a family we go tubing and if you are ready to be pulled in the tube the captain of the boat and passengers may not be able to hear you due to being far out from the boat so we initiated a thumbs-up means good to go. Much like the green means go on a traffic light, the APB to me means thumbs-up green for go. I hope I have instilled that this color situation has to mean something to you in order for you to make it easier on yourself to remember during a time crunch when hooking your patient up and everyone in the room is standing around waiting on you; looking at you to hurry up because you’re holding up the whole show. If it’s something you can easily remember, than at a time when you may need to troubleshoot and have to crawl under the sterile drapes you won’t have to second guess which color you plugged into which muscle and which pod and number.

When talking with some seasoned technologists from various facilities and companies, I learned that some have standard set ups to ensure everyone monitoring in the OR uses the same color pattern for placement in each muscle, pod, or amplifier plug in. This is great when working somewhere that allows for another technologist to come in, relieve you for a break or take over because it’s the end of your shift. In my situation where I work for a traveling company, there is no one to do that for me. We do have a standard program that everyone in the company uses for a particular type of surgical case. But as individual monitoring technologists, we have the ability to use our own color scheme that works best for us. I don’t have to worry about someone coming in during the case and not knowing it. Is this good or bad? I don’t know. Maybe it eventually made it easier for me to remember after repetition but if I worked at a facility that mandated a color scheme it may have been harder for me to make sense out of it for myself. I have learned there are always pros and cons with everything.

Now we need to talk about inserting recording leads in the head. I use single subdermal leads for this. The supplies my company orders have six colored single leads available. I use green for ground, black for cervical, yellow for Fz, white for Cz', blue for C3', and red for C4'. This is where my EEG background comes into play again. I ran my EEG waveforms in color. Left was blue and red was right. We all know with the International 10–20 System the even numbers are on the left and the odd numbers are on the right. I want to stress here the importance of the International 10–20 System for electrode placement. Now if, for whatever reason, it is not possible to utilize the appropriate measurement system and you are using the thumb and finger technique also known as the “Itsy bitsy spider”; then what made this easier for me, which I
learned from a couple of experienced technologists with a neurodiagnostic background, was in order to locate C3’ and C4’ to get good data I needed to drop my thumbs back towards the parietal area of the head once I located the Cz (not Cz’) location and place the leads for C3’ (C3 prime) and C4’ (C4 prime).

Something that I feel is extremely important to protect is my head lead wires. Anesthesia is always getting under there and I hate having to replace leads because anesthesia accidentally pulled them out. But as we all know, if a head lead is pulled out you are not going to get data. Another helpful hint when placing head leads is make sure the hubs of the wires are coming up and then down. For example, if the patient is prone (face down) place the lead in a position that the hub is on top and the same if the patient is supine. When first learning, I placed leads one time with the hub at the bottom because the patient was asleep but not flipped yet. I found out quickly why not to do that. First off they easily fall out especially during the flipping and positioning. Then I put a strip of tape around them and leave enough excess hanging to plug into my pod (remember the yellow sticker for the sun/head). Because as we all learn those lead wires are like little antennas all over and will pick up all that noise and interference we don’t want to see in our averaging waveforms for SSEPs.

We also have SSEP stimulating leads to remember. I know some technologists use needles and other techs use sticky stimulating pads. I use the sticky pads unless it is a CEA. Then I use needles due to the IVs in the patients arm. The needles are easier to get into a smaller area that is taped up to hold the IV in place. Occasionally there are those rare instances when I have to use needles for my SSEPs in a spine case for posterior tibial nerve (PTN) because the patient’s ankles may be edematous. A situation that can affect the PTN, median, and ulnar nerves may be the patient is sweating and the sticky pads and tape will not stay on, or maybe it’s because anesthesia has had a heck of a time with getting an IV in and there may arterial lines, too. Then there just isn’t any room for my sticky pads because of all the lines. I don’t want anesthesia to accidentally pull them off during the case while they are messing with the IV or arterial line, because if the SSEP sticky stimulating pads do get pulled off or they are no longer making good contact with the patient’s skin then that means I have to crawl under the drapes to press on them. If that doesn’t work, I have to replace it completely and thread my new wires back to the stimulating box to be plugged in which can definitely be a feat.

While I’m talking about SSEPs and anesthesia, please keep in mind that it is important to work together as a team, but you can still run your own train of four (TOF) for twitches to check for muscle relaxation prior to stimulating screws. If you are not sure if the patient is still paralyzed, most the time I have found if I do not see the hands visually twitching when I stimulate for SSEPs, it means the patient is still paralyzed and I have no twitches with my TOF or I may only have one twitch with fade. This is just a helpful tip to remember that may assist you in a pinch.

When I am plugging in the SSEP stimulating electrodes, it is set up in my machine for left to right starting with left PTN to right PTN and then left ulnar nerve to right. If I am running median nerve, too, for cervical then it is left median next than right. Again this goes back to EEG
– always left over right. A good way to remember it is TUMs. T for PTN, U for ulnar, and M for median. Plus I don’t forget, similar to EEG the odd numbers are on the left and even numbers are on the right.

Please be sure to remember when placing SSEP stimulating leads that the anode is positive; which is red on my stimulator box and should be placed distal (farthest from the head). I remember this from school as “red away from the head.” Some technologists say no red heads. Next is the cathode which is negative and is black on my stimulator box. This sends the current. I remember this from a phrase an experienced technologist taught me. Negative to black cats and black cats climb up a tree. Analogies, rhymes, and colors have always been very helpful to me when learning and makes it easier for me to remember.

I’m not sure of the colors used for stimulating by some technologists but the supplier my company purchases sticky stimulating pads from come in a pack of four and the colors are red, green, blue, and black. I tie the red and blue together and the green and black together (Figure 8). Red and green is the anode and black and blue is the cathode. I place green and black on the left and plug in to the appropriate number and in the correct order stated earlier. Then I place the red and blue on the right because red is always on the right (going back to EEG) again using the corresponding number and order when plugging them in.

FIG 8. SSEP stimulating wires

I place the stimulator box at the end of the table either on top of the patient’s legs with a foam cushion under it or if my patient leads are long enough to allow for it, I have Velcro® on my stimulator box to secure the box on the side of the OR table (Figure 9). This enables me to put the short lead wires (1.5 M) on the PTN because it is closest to the box and use the longer lead wires (for instance 2.5 M) on the ulnar if it is a lumbar case because the patient will be in the superman position.
FIG. 9. Stimulator box is secured to the OR table with Velcro®.

I know some technologists tape the pod cables and stimulating box cable to the side of the OR table but I prefer to use Velcro® (Figures 10 and 11).

FIG. 10. Cables are secured to the OR table with Velcro®.
FIG. 11. Velcro® is used to secure the cables under the OR table.

The slider table used in spine surgery enables the C-arm imaging to move around the table during surgery with ease. In Figure 10, this table has the arch pads for the lumbar case during which the patient’s chest lays on top of the pads to create a kyphosis curvature of the spine. In Figure 12 you can see the slider table without the arches for an anterior cervical case. In some types of surgical cases, the head portion is removed and a different head piece added to allow the patient to lay prone in a posterior cervical case for example. The patient’s face will be in one of the many mechanisms available such as a face mask attached to a mirror allowing anesthesia visibility to the eye region of the face to watch the swelling in the eyes and the intubation tube. I have learned from anesthesia and the surgeons that after lying prone for a prolonged amount of time and receiving IV fluids, the patient’s eyeballs will retain that fluid and cause edema which can lead to blindness if not monitored closely.
Using Velcro® on the Jackson table is quick and easy to take off and move if needed when the surgeon and team are positioning the patient and quickly moving the hip pads and chest pads by sliding them up and down the Jackson table into an appropriate position for the patient to reduce any possible pressure points. The Jackson table as I am accustomed to it being used for lumbar cases and set up as shown in Figure 13 and 14 illustrating the Velcro® being used to hold the cables up out of the way during the case when computed tomography (CT) is used to assist in placing screws and interbodies. The patient’s legs are propped up at the far end with pillows and the head is hanging in the prongs with weights at the opposite end. Or in the case of an anterior cervical, it is the Jackson frame with a flat bed and the cables can be tucked in along the edge all the way down under the padding the patient lays on. For anterior lumbar interbody fusions (ALIFs) I am familiar with the Jackson table being used to implement both the frame and the flat top allowing the patient to be sandwiched for a flip and eliminating the need to be moved from table to table. Also Velcro® is not near as messy as tape. There is no sticky residue left on the OR table let alone on my cables. But I do use a small skinny strip of silk tape to secure the upper extremity SSEP wires to the OR table after tucking it under the elbow pad and continuing to run it down to the stimulator box. I use a small strip of silk tape gathering all the upper extremity lead wires going to the two pods close to the head during an anterior cervical disectomy fusion (ACDF) case so that they are out of the way when CT is taking images for the surgeon during the case to show screw and plate alignment. The surgeons really appreciate this since sometimes it is difficult for them to see a good clear picture of the neck. It is best if all lead wires are out of the way as much as possible.
When I am applying my leads I make sure the needles are going in the direction that will make them easy to remove at the end of the case. Please be mindful if you are flipping the patient not to place leads that may tear skin when pulling them out at the end of the case due to being placed in the opposite direction while the patient is supine after intubation. When taping the leads down I stress loop them much like I do leg leads on PSG hook ups. Speaking of all this tape, I tear my silk tape into the size of pieces I need and place them up and down my pant legs (Figure 15) while I am turning my computer on, logging on to the internet, and opening up my program. Sometimes I tab the corners to make it easier to rip off my pants; this too is a habit from my PSG days.

A colleague actually tears tape in advance and puts them on top of each other but I have never been able to master this technique. After it gets so thick it always falls off my leg. Another IOM technologist I meet at the 2010 ASET Annual Conference in Louisville, KY told me about the advantages of wearing a fanny pack (Figure 16) made of a material that can be wiped down after each case. Carried in the fanny pack are electrodes, ETOH pads, extenders, gauze, and tape.
readily available to be used along with a pair of scissors attached by means of an ID pull string badge which is sometimes handed out by vendors or facilities where employees work. These holders appear to be quite handy by attaching the vinyl snap strap around the scissor handle and clipping it to your scrub pant waist or clipping to the fanny pack (Figure 16). Your scissors are readily available when needed so you are not asking a nurse in the room if anyone has scissors available and everyone is checking their pockets and searching the drawers. Be sure when removing needles you get all of them out of the patient and don’t leave any in the patient perhaps under the leg compressions due to the wire breaking from being pulled on during removal of the wires prior to wake up time.

I pre-open my packages right before the patient is brought into the OR suite and I place them in order to be used by putting all my left leads in my left pocket and right leads in my right pocket. Another technique I acquired from a seasoned technologist was to open my single leads after tearing the tape I placed on my pant leg, then wrapping my ground and cervical leads together around approximately three fingers (Figures 17 and 18) and placing them in an open package (Figure 19). Then the rest of my single head leads I repeat the previous steps (Figure 20, 21, and 22) and place both packages behind the paired lead packages in my left pocket, so when I pull them out to place them I have in my hand all the leads I am going to use in that area. For example one package (Figure 19) has ground which I place in the shoulder and cervical which I place approximately in the C2 spine area, the indentation found directly under the inion. In another package I have color leads (Figure 22) for the rest of the scalp lead placements. Behind those I place the packages with my MEP leads. If I go to a facility that does not have two front pockets on their surgical scrubs, it is somewhat awkward for me to figure out how I am going to carry all the leads I need and it can throw me off my game momentarily. Unfortunately not all ORs have the same style of surgical scrubs. Some may have pockets, some may not, some may have a breast pocket, and some may have only one hand pocket. Some styles have a mixture but we have to wear the surgical scrubs provided by that facility.

FIG. 16. Fanny pack to hold supplies, and scissors on pull string badge holder clipped to side of fanny pack.
FIG. 17 and 18. Wrapping ground and cervical lead together.

FIG 19. Ground and cervical leads ready prior to case starting for more efficient set up.
For procedures that require MEP monitoring, I place two single leads tied together; sometimes two sets of two for MEP placement to run MEP data. These two stimulating needle electrodes need to be placed in the scalp in the C1 and C2 area; I have also used the C3 and C4 area. Note I did not state C3’ and C4’ prime since these are different areas on the scalp. I recently have been placing both sets to cut down on my troubleshooting time not to mention lessen moving and reinserting the needles repetitively in the patient’s scalp to find good MEP data responses. I don’t like sticking the patient multiple times even though I know the patient is
anesthetized and cannot feel nor remember it. This way I only need to unplug one set and plug in the other set which I always have wrapped like my SSEP recording head leads to gather up the slack of the long wires. Then I tape the wires on the MEP stimulating box. I have been reading several articles involving MEPs and have still not found an exact science to this. (Anyone who has; I am always happy to listen and learn.)

Make sure prior to stimulating MEPs that anesthesia places a bite block in the patient’s mouth to reduce the risk of tongue lacerations which is the most common side effect of MEPs. A bite block can be in the form of a tampon. I have seen some CRNAs choose to use an oral airway. I usually wrap a few 4x4 gauze squares around a wooden tongue depressor and secure it with silk tape for the CRNA to place. I have found the CRNAs prefer this method and then they break off the excess wooden tongue depressor that is sticking out especially during an ACDF so that it does not interfere with the sterile draping that is placed over the patient’s face.

I am currently working on my technique for MEPs and have not found a definite reliable stimulation site that is the same in every case because I have found that it is not in the same place on every patient. Remember when we are stimulating MEPs, also known as Motor Evoked Potentials, we are sending an electrical charge to the cortex to evoke a CMAP (compound muscle action potential). We need to keep in mind the homunculus but at the same time remember not all brains are the same. I have found recently from a very experienced IONM technologist that data seems to be acquired easier when using the smaller more intrinsic muscles rather than the large muscles. Now, for example, using paired subdermal needle electrodes, I place one of the paired needles in the APB and the other needle from the same pair in digit minimi and I have achieved better results. But this subject is a whole other topic that hopefully can be covered by someone in another issue.

A few more tips, try to always carry an extra pair of gloves in your back pocket or side pocket. When I am carrying my equipment and supplies in to set up, I always carry in an ink pen, a tape measure, and marking pencil into the surgical suite with me as well as gum or hard candy in my pocket to get me through those long days or extended cases since I do not have someone to cover me for meals or breaks.

I am aware some technologists chose to leave during exposure because they and other staff, maybe even the surgeon, feel they are not needed at that time. I had an incident that happened during the exposure on an ALIF that I was able to catch due to the fact I was there and had not left the room. The surgeon was very thankful that I caught the change and made him aware of it immediately. It allowed him to take measures that ensured a viable outcome for the patient. This, too, could be a whole other topic for an article.

To brand new OR technologists or someone considering going into OR monitoring, **never** carry your whole equipment bag or case into the surgical suite. It is not sterile and only sterile items are allowed in the OR suite, especially since the majority of some monitoring surgeries involve instrumentation placement. Hence a sign on the door that states please do not enter during surgery. It is preferred that going in and out of the OR suite be kept to a minimum and preferably through the sterile core door and not the general door to eliminate the possibility
of infection (Figure 23). I have recently seen a facility that placed a big X tape across the non-sterile door to prevent traffic in and out during the procedure. Also never enter the surgical suite without a mask because even if they haven’t started opening, they may start opening while you are busy carrying equipment in and setting up.

![Image](image.png)

**FIG. 23.** Sign on OR door to limit room access.

Always be sure to wear a hair net once entering the surgery area as well as shoe covers. Some facilities will allow hair bouffant or caps that are purchased in pretty colors and cool designs. But I have found during my travels in the past year, a lot of facilities are starting to eliminate this supposedly due to patient infections. An OR nurse manager explained to me that some people apparently do not take their caps home and wash them on a regular basis and this could be a cause for patient infection according to a recent study that has been brought to the attention of OR hospital facilities throughout the country. Some places will not make you wear shoe covers if you wear the same designated pair of shoes only in surgery and never outside the OR, much like the gym shoe rule in school when you were growing up.

Be careful to not touch anything blue! If it’s blue than it is sterile (Figure 24). If you even brush it or graze it you will contaminate the equipment and it will have to be resterilized which could take a while depending on the recommended protocol for that particular piece of equipment or if it’s disposable it will have to be thrown out and a new one opened. What I found that is easiest for me is to try and not move around the room anymore than what is absolutely necessary. I always make sure to tell the gowned scrub tech, surgeon assistant, and surgeon that I am right behind them or beside them. I make sure they acknowledge me even if it’s just a glance. I walk around holding my own hands so as not to swing my arms unknowingly and possibly risk touching something that would break sterile field.
It is our goal as technologists to work together with the surgical team as a whole and not be some invisible person or quiet mouse in the corner. Be sure to speak up when talking with the surgeon so he can hear you. Acknowledge when he speaks to you. Communicate throughout the case with anesthesia because everything they do or don’t do has the potential to affect our data, including the anesthesia that is being administered, and other types of drugs they may be giving the patient. The blood pressure, mean arterial pressure (MAP), and temperature can also affect our data and cause changes. EEG, if being monitored, and BIS (Bispectral Index®, Aspect Medical Systems, Newton, MA) can be used as tools by the technologist to assist in troubleshooting any changes that may be seen in the patient data.

The whole goal is to work with everyone in that room, the surgeon, the nursing staff, anesthesia, and sometimes even radiology and sales reps, while still staying out of everyone’s way but yet try to keep all the leads intact to enable monitoring of the patient with the best results possible and all the while assisting in keeping the patient safe.

I hope these tips I have covered help you and eliminate the time it has taken me to talk with and learn these techniques from different IONM technologists over the last 14 months. I wish I would have had something similar to this that would have laid it all out for me ahead of time so I wouldn’t have been so clueless wondering, “Now I’m inserting what color leads into where and then plugging them into which place?”