Breast Cancer: Functional Implications and Physical Therapy Management

Recorded September 4, 2019

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PhysicalTherapy.com Course #3532

- [Calista] All right. Well, our presenter today is Dr. Stephen Wechsler, and Dr. Wechsler's a physical therapist at Memorial Sloan Kettering Cancer Center's outpatient Silverman Center for Rehabilitation in New York City. Dr. Wechsler currently serves as the secretary for the Academy of Oncologic Physical Therapy. In recognition of his efforts and participation in the APTA, Dr. Wechsler was awarded a 2017 APTA Emerging Leader Award, and in 2019, he received the President's Award for his efforts with the Academy of Oncologic PT as well. He has lectured locally and nationally on the topic of oncologic rehabilitation. So we are glad that he has returned back to physicaltherapy.com. And if you miss his prior presentation, I recommend that you guys see that on the recorded course. So at this time, I'm gonna turn the microphone over to you, Dr. Wechsler. And thank you so much for presenting again for us today.

- [Stephen] Okay, thank you Calista, and good afternoon. So as Calista mentioned, my name is Steve Wechsler. I'm a physical therapist and a board-certified neuro clinical specialist, and today, I'll be talking about breast cancer, and in particular, functional implications and the physical therapy management of functional impairments that we commonly see as a result of breast cancer and treatment for breast cancer. Whether or not you work in a cancer rehab specific setting, because of the prevalence of breast cancer survivors, which we'll go into the data in a moment, there's so many breast cancer survivors in the United States and around the world that, no matter what setting you work in, you are going to see women with a history of breast cancer. So it's really important that you're able to confidently screen and evaluate these patients and develop a plan of care to help them. So without further ado, without further ado, no disclosures today. For our learning outcomes. So after this course, I'm hoping that you, as the participant, will be able to identify the anatomical structures that may be impacted by breast cancer and its treatment. The anatomical structures around the female and the male breast, for that matter. They're not as commonly taught in DPT curriculum. I think oftentimes we aren't as familiar with that region of the body as, say, a shoulder or a knee or low back. So we'll talk about the anatomy in that area and how

it may be impacted by breast cancer and its treatments. We'll talk about evidence-based outcome measures throughout that are recommended for use with breast cancer survivors. And then we're gonna dive into kind of three separate categories, I guess, of functional impairment as it relates to breast cancer. We're gonna talk about shoulder impairment secondary to breast cancer treatment. We're gonna talk about chemotherapy-induced peripheral neuropathy and increased risk of falls due to breast cancer treatment. And then we'll also talk about lymphedema. Now I am not a Certified Lymphedema Therapist, but I think that it's also really important whether you are or are not a Certified Lymphedema Therapist that you understand why a patient may be at risk for developing lymphedema and you know how to educate that patient to minimize their risk for developing lymphedema as it relates to both breast cancer and other types of cancer. So breast cancer. This is the most common cancer in women, excluding skin cancers. One in eight women, which is obviously a high number, 12% will develop invasive breast cancer in their lifetime. Breast cancer does occur in men, though you can see here, at a much lower instance. Here are some estimated numbers for 2018.

So you can see the number of women and men diagnosed with invasive breast cancer here as well as the deaths attributed to breast cancer. This is really the take home number from this slide, though. So currently more than 3.1 million breast cancer survivors in the United States. So as I mentioned on my title slide, there's so many breast cancer survivors in the United States no matter what kind of practice setting you work in, you will see patients with a history of breast cancer. And the reason there are so many survivors is really due to that high number in the top right hand corner of your slide there. So the five-year survival rate for breast cancer is now close to 90%, which is really amazing. So you can see the estimated new cases in 2018 accounting for about 15% of all new cancer cases, but only accounting for just under 7% of all cancer deaths. You can see the general trend of the darker green line towards the bottom of the slide, which represents the deaths due to breast cancer, and it is continuing to

slope downwards, and that is due to earlier screening, earlier detection, and improved treatment outcomes. So now let's talk a little bit about the anatomy of the female breast, in this case. So looking at sort of the cutaway view on the right side of the slide, breast tissue is, in large part, fatty tissue. You can also see the lobes here where milk is produced, and then ducts where the milk is transported then to the nipple. I like to think of this sort of in layers. So you've got the breast tissue, including the lobes, the ducts, and the nipple, and then diving a little bit deeper, we've got the chest wall muscle. So we've got the pectoralis major.

And then going a little bit deeper, you've got the pectoralis minor, and then even deeper, you've got the ribcage with intercostal muscles, and then even going another layer in, you get into the thoracic cavity with the pleura and the lungs. So we'll talk about different breast cancer treatments and we'll sort of frame it in the context of thinking about the different layers of impact that it can have. Looking now towards the left side of the screen. So again, you see the female breast here. Now you can see some other structures here. You can see the bony landmarks. So of course, you have the sternum and the manubrium medially along with the sternoclavicular joint, and then extending laterally to the acromioclavicular joint as well as the green lymph nodes, which are pictured there and labeled.

We'll talk a little bit more about implication of cancer and cancer treatments on those lymph nodes, but just so you can sort of start to develop a sense of where they are anatomically. So again, thinking about layers, diving even deeper now. What I explain to a lot of my patients is, there's a lot of stuff going through the armpit. There's a lot of stuff that travels through the axilla and out into the arm. So included in that stuff is the arteries here, pictured in red, the brachial plexus, pictured in yellow, and of course, there are veins as well as the lymphatic vessels and lymph nodes that we saw on the last slide as well. So you can see the chest wall muscles reflected away here as well as the bony structures. So again, we'll talk about how cancer treatments can impact

different layers and different body structures here. So different types of breast cancer. So breast cancer is named for both the location and the extent of the cancer. So in terms of location, primary breast cancers arise either from the ducts or the lobes, in which case it would be called either ductal or lobular. And the extent, and it's either termed in situ or invasive, where in situ is really an early stage and invasive is kind of what it sounds like. It's a more advanced cancer. So combining all of that, we've got ductal carcinoma in situ, invasive ductal carcinoma, which is the most common invasive breast cancer. Then similarly, we have lobular carcinoma in situ and invasive lobular carcinoma.

Okay, so cancer either arising from the milk ducts or the lobes, and termed either in situ or invasive. You can see again in this picture the different layers. So you have the breast tissue and then the chest wall muscles as you go deeper. So in terms of breast cancer treatment options, we're gonna break it down a little bit into surgical options and then additional treatment options, which I've termed either adjuvant or neoadjuvant. Just a quick refresher. As Calista mentioned, I did give a lecture earlier this summer on sort of the cancer rehab basics and overviews, and so this delves a little bit more into these terms and how it relates to chemotherapy, radiation therapy, hormone therapy. But adjuvant is any treatment that is delivered after another treatment.

So remember that adjuvant, A, after, adjuvant, after. Whereas neoadjuvant is treatment that's delivered prior to another treatment. So in terms of surgery, there's breast-conserving surgery, which is, to offer some other terms, lumpectomy falls underneath this category of surgery as well as a partial mastectomy. Then there is a full mastectomy. There are different lymph node procedures. So there's a sentinel lymph node biopsy, or abbreviated SLNB, you might see that in the medical record, or an axillary lymph node dissection, ALND, which is more invasive. And I'll go through, with a little bit more detail, these two procedures. And then there are reconstructive options

included in surgical options to treat breast cancer. In terms of adjuvant and neoadjuvant treatments, sort of the big three are radiation, chemotherapy, and hormone therapy. Just to break down radiation even a little bit more, there's external beam radiation, which is sort of the traditional thought about radiation, where radiation is directed at the body from an external source. And then there's also internal radiation therapy or brachytherapy, where radioactive seeds, in many cases, are implanted in or around the tumor or the tumor bed to help decrease the chances of cancer recurrence or cancer spread, if there happen to be any residual cancer cells. So now let's pick apart these surgical treatments a little bit more. So as I outlined, there's the breast-conserving treatments, surgical options, mastectomy, lymph node procedures, as well as reconstructive options.

So think about breast-conserving surgery. This is a lumpectomy or a partial mastectomy just to use some different terms. So this is essentially where the surgeon goes in and removes just the tumor, leaves the breast tissue or the breast mainly intact, but removes the tumor and tries to achieve negative margins, meaning they remove all of the cancerous cells and there's no cancer left in that area. So you can see that depicted here in sort of the middle picture on this slide. What this is depicting is that a breast-conserving surgery can also be paired with a lymph node procedure, either the sentinel lymph node biopsy or the axillary lymph node dissection, which I'll get into in a few slides. So in terms of mastectomy, there are actually a couple options sort of within this surgery. There is the simple or the total mastectomy, oftentimes abbreviated TM.

A simple mastectomy or a total mastectomy is, the surgeon goes in and removes all of the breast tissue, all of the overlying skin, as well as the nipple of that breast, as opposed to the skin or the nipple-sparing mastectomy, which is exactly what the name entails. The surgeon removes all of the breast tissue, but is able to spare the skin and/or the nipple of that breast. There's the double mastectomy, which I think what we're most familiar with in terms of prophylactic treatments. So if a woman develops

cancer on, let's say, her right breast, and she's deemed to be at risk for recurrence in the left breast, they may do a prophylactic double mastectomy. Then getting a little bit more invasive, there is the modified radical mastectomy, abbreviated MRM. This is a total mastectomy with a lymph node procedure. So either that's sentinel lymph node biopsy or the axillary lymph node dissection. And then even one step further, the radical mastectomy, or RM, is the total mastectomy with a lymph node procedure as well as the removal of chest wall muscles. Now the radical mastectomy is, sort of as its name entails, it's pretty radical, it's a big surgery. I think this used to be more of a standard of practice, but as techniques have advanced, I think we see this a lot less often. More commonly, we're seeing the modified, excuse me, the modified radical mastectomy.

So here we have the modified radical mastectomy. So this is removal of all of the breast tissue as well as the lymph node procedure, which you can see the lymph nodes included on that left side of the screen. Now on the right side of the slide, this is a little bit misleading, I think, 'cause it looks as though one of the chest wall muscles is included in that excision inside the red dotted line. But if the chest wall muscle was being removed, that would make it a full radical mastectomy. So I think that's just a little bit of an error in this picture. So the modified radical mastectomy, all of the breast tissue, including the tumor, of course, paired with a lymph node procedure.

Okay, so I've been talking a lot about these lymph node procedures. So the sentinel lymph node biopsy we'll go through first. So this is essentially where, intraoperatively, the surgeon injects the tumor with a radioactive substance or a dye. And then they watch where that radioactive substance or dye goes first. They track it to see which lymph node in the axilla or around the breast that tumor would be most likely to spread to if cancerous cells left that tumor and spread to the lymph nodes. They'll then, again, intraoperatively, remove and biopsy that lymph node and see if any cancer cells are present. If there are no cancer cells present, the surgeon can reasonably assume that

cancer has not spread past the primary tumor. On the other hand, if there are any cancer cells there, sometimes in the case of even one cancer cell present in that lymph node, there is an increased risk or an indication that the cancer may have spread from the tumor to at least those lymph nodes, and perhaps beyond them, in which case, the surgeon may elect to convert to an axillary lymph node dissection. So the sentinel lymph node biopsy is just the removal of those sentinel lymph nodes, sometimes just one or two or three of the sort of first stop from the tumor.

And if need be, the surgeon may elect to convert to an axillary lymph node dissection, which is much more invasive. It may be done at the same time as that primary surgery, so they may elect in that moment, or they may actually opt to just complete that primary surgery and then actually go back in at another time and do the axillary lymph node dissection. But this is where, really, all the lymph nodes that are present in the axilla are removed. So this has a range, dependent on that person's unique anatomy, but anywhere from 10 to 40 lymph nodes can be removed. Now, I don't have a great picture of this, but I am going to superimpose this red line to show you where the scar usually is for an axillary lymph node dissection and even sort of how the scar is oriented. The scar is typically a horizontal scar or more running from anterior to posterior in the axilla.

This can be a site of a lot of pain postoperatively for a woman, even subacutely or chronically, which we'll get into when we talk a little bit more about the shoulder. This scar tissue here, if we again think about all that stuff that runs through the axilla and out into the arm, scar tissue here and adhesions that are associated with this axillary lymph node dissection can really cause some issues in terms of freedom of movement in this area of the body. And so breast reconstruction. So there are a lot of options for breast reconstruction. The options are dependent on the type and the extent of the primary surgery, whether that woman is going to require additional treatments, whether it be radiation or other adjuvant treatments. And patient preference is certainly taken

into account here as well. Some women opt to not undergo reconstruction, thinking that it is just another procedure that they have to recover from and it sort of prolongs the whole process, which I think is, in some ways, true. But for many women, it's not so cut and dry. There's a lot of psychosocial considerations when it comes to breast construction. A lot of issues arising around sexuality and body image. So there's a lot of thought process that goes in sort of on both sides of the desk here. There are different types of breast reconstruction. The surgeon or the patient may opt for an implant, and there are different kinds of implants that can be used. There are different tissue flap procedures, which we'll go through, and there are even some options for nipple and areola reconstruction, in some cases using a skin flap to reconstruct the nipple and the areola. In other cases, I've actually seen some really, actually, some pretty amazing tattoo reconstruction where a tattoo artist will artistically reconstruct the nipple and the areola. And the timing of the breast reconstruction, it may be immediate. So it may be part of the primary surgery so that it's sort of one and done, or it may be delayed. And again, that may be dependent on any additional treatments that are planned.

So talking first about reconstruction with an implant. So as I keep saying, this may be done immediately within the primary surgery, or it may be delayed. Reconstruction with an implant is typically performed using a tissue expander, where a tissue expander, or abbreviated TE in the medical record, is inserted oftentimes within that primary surgery, sometimes right behind the pectoralis major to utilize it as a sling. Though I've seen more frequently or more recently more surgeons opting for what's called a prepectoral implant, which is an implant that actually sits on top of the pec major. But that tissue expander, following that primary surgery, is expanded at regular intervals and filled with saline fluid. And as the name insinuates, it expands the tissue until that tissue expander is eventually exchanged for a permanent implant. So I'm gonna bring you back now to what I mentioned about the various tissue levels. The implant can have impact on various tissue levels. So I've designed a very crude diagram here. So here's a very

crude pectoralis minor, okay? So think of this as a left pec minor. The patient is looking at us. So the pec minor is attaching from the rib cage onto the coracoid process of the scapula. It's all happy until one day, this implant is placed right on top of it. And so now it is aggravated. It may be hypertonic. Thinking about the impact that that might have functionally on the shoulder, functionally on the posture.

And then you've got this pec major that is stretched to its capacity being utilized as a sling in this particular case. And so now the pec major is unhappy. It may be hypertonic, it may be painful. Think about the impact it's having in terms of causing internal rotation of the humerus. The shoulders may be coming forward. The scapula may be anteriorly tipped, or winging. So thinking about the impact that this may have on the various tissue levels and certainly what impact that can have on a bigger functional level, on a bigger activity and participation level. I'll stay here for just one second. Even diving even deeper down to the ribcage and the intercostal muscles, sort of this new foreign object pressing down onto the ribcage, might that be limiting ribcage expansion and therefore limiting cardiopulmonary function.

So this can have various impacts on different tissue levels and on different systems even. So that was really talking about implant procedures, and now we'll talk a little bit more about flap procedures for reconstruction. So some of the more common flap procedures that we see is a TRAM flap, or a transverse rectus abdominis muscle flap. A DIEP flap, named for the deep inferior epigastric perforator artery that is used to, it's harvested with the flap and used for the blood supply. There's the lat flap, or the latissimus dorsi flap, then the GAP flap and the TUG flap. Both of those last two, the GAP flap and the TUG flap, I think are maybe not as common as they used to be. I've only seen a handful in my career. But dependent on the patient's body habitus, where they have the appropriate amount of tissue for harvesting, those may be options for that patient. Now with some of these flaps, it may be done different ways. It may be a free flap, where the body tissue is harvested, removed completely from the body and

then relocated, so to speak, to reconstruct the breast. Or the flap may be pedicled, or tunneled, where the body tissue is not actually fully removed from the body, but merely reflected into place to reconstruct the breast. And I'll show you some examples of those. So starting here. So here we have an example of the TRAM flap, the transverse rectus abdominis muscle flap. So this is showing it as a pedicled procedure. It's not always the case. Sometimes, it's a free flap. But you can see here, the rectus abdominis muscle is reflected and actually tunneled underneath the skin to help reconstruct the breast. So the flap procedure may be combined with an implant, as you can see in this picture. So in this case, the pectoralis major would not be used as a sling. Rather, the rectus abdominis muscle would be. But not always the case. Sometimes, the flap procedure is done without an implant as part of that procedure. And so we have to consider the functional impact of the flap harvesting, depending on where the flap has been taken from. So here, obviously, there's going to be decreased integrity of the abdominal wall. It does leave a relatively large scar. I shouldn't even say relatively. It leaves a very large scar along the inferior aspect of the abdomen, as you can see in that horizontal blue line.

So oftentimes, women experience tightness around the abdominal incision, experience core weakness. Thinking about the later on implications of that, whether that may materialize as back pain. There can be sort of a cascade of functional impairments that we see even just from the flap harvesting. So the DIEP flap. So this is performed as a free flap procedure. So this gives you the other perspective. So this is where an area of skin and fat is removed. Microvascular surgery is used to transpose that deep inferior epigastric perforator artery, for which the flap is named, up to the breast where the artery is reconnected. Now, because this is a microvascular surgery, there may be more conservative post-operative precautions. Now, every surgeon is different. Every surgeon and institution has its own protocols, but oftentimes, because of the microvascular component of this surgery, surgeons often ask that we limit manual therapy over the flap to ensure that it is viable. And also there is usually a period where

we have to limit abdominal strengthening to allow the abdominal incision to heal properly. This isn't a fabulous picture, but gives you just an idea of what a latissimus dorsi flap looks like. So again, this is a flap that is oftentimes pedicled, where the latissimus muscle is cut and then actually tunneled anteriorly under the skin to then help reconstruct the breast, either with or without an implant as well. So thinking about the functional implications of this, not just pain and tenderness at the actual breast surgery site, but what functional implications there may be at the latissimus dorsi.

So thinking sort of on the bigger picture about rehab implications after surgery. So like after any, even orthopedic surgery, there's going to be pain, tenderness at the surgical site. There may be swelling. This is different from a lymphedema swelling, and we'll talk about that, but this is common as it is after a knee replacement or any sort of surgery, def postoperative swelling. There's an increased risk of infection. There may be numbness around the axilla or the breast. We may see weakness at the upper extremity on the side that the breast surgery was performed or even at the donor site, whether that's the abdomen or the latissimus or, remember, even the gluteal or the gracilis area. Sometimes women experience neuropathic pain in the axilla and chest wall, and there's actually a term for this, post-mastectomy pain syndrome. This can be really distressing, both acutely, and this is a neuropathic pain.

This is a symptom that can continue on and actually end up being subacute or chronic in nature. So just to put this on your radar, this can be something that's really distressing for these women. I talked about some of the impact that the surgery and the reconstruction can have on soft tissue balance and muscle balance. Certainly this can cause postural impairments. The general theme is that structures in the anterior aspect of the shoulder and the chest get tight and short, and structures posteriorly, so thinking about the rhomboids and the middle traps, tend to get stretched out and passively insufficient or actually passively insufficient and weak. And then we may oftentimes see limited arm and shoulder range of motion, which we'll talk about in

much more depth. So now to talk a little bit more about the adjuvant and neoadjuvant treatments of radiation therapy, chemotherapy, and hormone therapy, and the impact that they can have in addition to the surgical treatments. So radiation therapy is often recommended as an adjuvant treatment, remember, adjuvant, after, recommended as an adjuvant treatment for breast-conserving surgery. And that's because, with breast-conserving surgery, just the tumor is removed and radiation is then used to make sure that there are no residual cancer cells that can lead to a recurrence or lead to a spread. Radiation therapy may also be indicated in cases of mastectomy, even when the full breast is removed either to target residual cancerous breast tissue that may still be present or to target potentially positive lymph nodes. And the timing may be dependent on the reconstructive procedures.

So sometimes if a woman is waiting to get an implant, they may opt to do the radiation therapy after she gets the permanent implant or before the permanent implant is placed or exchanged. Sometimes it can be different from case to case. So I'll pause just for a moment just to take a look at this picture. So this, as I mentioned, I mentioned there were two different types of radiation therapy in most cases. There's external or internal.

So this an example of external beam radiation therapy. And the position that the woman is in, you can see here, with her arm up over her head. This is the most common position that women need to be able to achieve to actually get radiation therapy, external beam radiation therapy. So oftentimes, women are actually referred to the clinic that I work in postoperatively in anticipation of having to get radiation therapy, and their order will be expedited and saved. It'll say, we need range of motion to get the radiation therapy started, so work on that. So that'll be our primary first and foremost goal. Sometimes it'll dictate developing our plan of care a little bit differently than we normally would. If we know that she's starting radiation therapy in one week or in two weeks, sometimes I'll put that woman on for three, four, fives times a week,

whatever I think she's gonna need in order to start the radiation therapy in time. Okay, so with that said, there are side effects that go along with radiation therapy, and I've broken then down into some of the more acute side effects that you may see with a patient who is currently going through radiation therapy, and some of the more subacute or chronic side effects that you may see towards the end of radiation therapy or even afterwards. So in terms of acute side effects, we may see swelling here. Now this is a little bit different from postoperative swelling. But radiation therapy does cause inflammation. It can cause swelling. We may see skin changes acutely where it actually looks like the skin has been sunburned, and that can progress to be even more open and blistering skin. And oftentimes, these women experience fatigue. It can be a global fatigue. Again, radiation therapy does cause inflammation, which is known to be one of the factors leading to cancer-related fatigue. Then looking at more of the delayed or subacute or even chronic side effects.

So radiation can cause soft tissue tightening and atrophy, which can further contribute to limited range of motion and other postural impairments. Brachial plexopathy is something that we can see as a result of radiation therapy. This has to do with where the radiation field is for radiation therapy to treat breast cancer. Oftentimes, particularly if it's in a more superior aspect of the breast, the brachial plexus may be within that radiation field and subacutely or chronically, that patient may develop a plexopathy, dependent on the dosage of the radiation, dependent on even the schedule of the radiation, how much radiation was delivered. Again, perhaps dependent on dosage, we may see weakening of ribs, as radiation therapy can actually impact the integrity of bone. And radiation therapy can also be a risk factor for developing lymphedema, and we'll get more into that when we talk specifically about lymphedema. So what are the rehab implications for radiation therapy? As if those side effects weren't enough. So I mentioned that radiation therapy can cause skin irritation. Skin irritation can progress just from being like a sunburn to actually leading to desquamation. And so we can see dry desquamation. And so if you've ever had a sunburn that then peels, you've

experienced dry desquamation. Radiation therapy can cause that dry desquamation. It can also progress to cause wet desquamation, where we actually have an ulceration of the skin and the membranes. You can have open, red, and tender and blistered skin. So certainly precautions should be taken around that red, tender, blistered skin. We do not perform any manual therapy over skin that is open or blistered or red. Even if it isn't blistered, redness and the tenderness indicates that the skin is a more fragile state. We usually limit our interventions just to active range of motion or active assisted range of motion, gentle therapeutic exercise, walking a fine line, really, between wanting to maintain function and optimize range of motion and function of that arm and that shoulder, but also to allow for tissue healing. Now radiation-induced fibrosis is something that we can see more subacutely or even more chronically.

And the underlying etiology of this is thought to be due to a microvascular injury caused by the radiation therapy, which leads to an ischemic hypoxia and inflammatory changes in the surrounding tissue. Now what this means is, basically, a loss of tissue compliance when it comes to muscle and skin and even lung. So again, think about that layer. Lung is really underlying and may be caught up in the radiation field. This we typically see, as I mentioned, subacutely or chronically, sometimes six months or even five years following treatment. So once radiation is done, we may still see these side effects of the radiation-induced fibrosis.

And really, the kicker here is that this can progress indefinitely, which I feel is oftentimes something that women are not aware of when they come through radiation therapy. So this can be a big point of education for our patients, really underscoring the importance of everyday stretching, teaching self-myofascial release as need be. Whatever we can do to help them maintain their function throughout survivorship. And as I just sort of mentioned, early initiation of active and passive intervention is key. So early stretching, getting in there early, talking about exercise, implementing a home exercise program so that things don't progress indefinitely and really start to restrict motion and function. So

some specific precautions related to radiation-induced fibrosis. So we have to be a little bit considerate about our use of modalities. Radiation fibrosis does cause a decrease in blood supply and oftentimes, decreased sensation in that area. So the same way that you would be a little bit extra careful about your use of heat and ice or neuromuscular electrical stimulation or even TENS in an area with decreased sensation or blood supply, applying those same considerations here. As I mentioned, we have to limit our manual techniques in areas of skin breakdown, and we may need to observe lymphedema precautions when indicated. We'll talk about exactly what those precautions are later on today.

So a few notes about chemotherapy for breast cancer. So there are different techniques or timing in techniques of administration. So chemotherapy may be used neoadjuvantly, which is prior to another treatment. In this case, most likely surgery or radiation. It may be used adjuvantly, or after surgery or radiation. And in some cases, chemotherapy may be used as the primary line of treatment to treat that primary breast cancer or recurrent or metastatic breast cancer. These are just some commonly used chemotherapies for breast cancer. You don't have to memorize these, but I just wanted you to see them so you may have a better chance of recognizing them.

So Taxol is a big one, and the common rehab impact of Taxol is that it frequently results in a peripheral neuropathy, which we'll talk about when we talk about chemotherapy-induced peripheral neuropathy. It can also cause cardiomyopathy. So some chemotherapies are actually cardiotoxic. Taxol is one of them. There's a class of chemotherapies called the platinums, and you'll recognize these. You can see that the two here, cisplatin and carboplatin, you'll see the plat suffix in there. These also have rehab impacts, can also cause peripheral neuropathy. Platinums are also known to be ototoxic. So they can actually impact the vestibular system and in degrading the stereocilia in the vestibular system. Cytoxan, doxorubicin, and vinorelbine are other agents. In almost all cases, not a single solitary chemotherapy agent is used.

Oftentimes, it's a cocktail. It's a combination of multiple chemotherapies that are used. And just some notes about hormone therapy now. So about 2/3 of breast cancers are hormone receptor-positive and what that means is that high estrogen levels help the cancer cells to grow and spread. So hormone therapy either works to reduce levels of estrogen in the body or it stops estrogen from acting on those breast cancer cells. Similar to chemotherapy, this hormone therapy may be administered neoadjuvantly, adjuvantly, or as the main treatment for the cancer, particularly in more advanced cancers.

So again wanted to just provide you with some of the more commonly used hormone therapies. Tamoxifen is a big one. This is called a selective estrogen receptor modulator, or an SERM, meaning that this works to block estrogen in terms of its impact on breast cancer and breast cancer cells, but actually works as estrogen throughout the rest of the body. So this can be a good option for some women. It does have some side effects. It does increase the risk of blood clot and bone loss. So osteoporosis is a big issue, particularly with prolonged hormone therapy for hormone receptor-positive breast cancers. And aromatase inhibitors. This is another class of hormone therapy used for breast cancer. So this stops estrogen production altogether.

So it is typically used in post-menopausal women who even post-menopausally, estrogen is typically produced in other places of the body, sometimes in the fat cells. And so aromatase inhibitors stops that estrogen production altogether. Letrozole, anastrozole, and exemestane are common agents here. And these have their side effects as well. Actually, they're prevalent enough that they've been given their own name, aromatase inhibitor-induced arthralgias, or AIIAs. Muscle pain, joint pain. This can be really distressing to women who are instructed to take aromatase inhibitors. Sometimes hormone therapy can last for five years, 10 years, following the primary treatment for breast cancer. And if it comes with joint pains and muscle pains, which in some case can be really severe and really limit function, this can be really, really, as I

mentioned, distressing for these women. So just to kind of summarize here before we move on. Treatment is often multimodal, as I've outlined. It's usually not just surgery, but it's oftentimes surgery paired with chemotherapy or radiation or hormone therapy. We have to understand the physiological effects of each one of those treatments, whether it's related to the surgery and scar tissue or the chemotherapy, radiation, and hormone therapy and the side effects that go along with those. Timing of the treatments may actually impact our rehab plan of care. Whether we are seeing them just postoperatively or if we're seeing them more in an outpatient setting, sort of how far out of surgery are they. If they're currently taking a chemotherapy and they're suffering from the side effects of the chemotherapy or, in a similar way, if they're experiencing the side effects of radiation therapy, we may need to be a little bit more creative, a little bit more flexible with our rehab plan of care to make sure that we can help them optimize their function.

This is the bottom line here. It's imperative to know what your client has been through or what they're currently going through, not just to understand from a physiological standpoint what they may be experiencing, but also an emotional and a psychosocial standpoint what they may be experiencing. Okay, so now we're gonna dive into shoulder impairment following treatment for breast cancer. So this is a commonly seen set of symptoms. This is more prevalent following an axillary lymph node dissection and radiation therapy. And this set of symptoms can significantly impact quality of life. So to look at really the incidence following axillary lymph node dissection and radiation therapy. XRT is a common abbreviation for radiation therapy. So this study found women who had had axillary lymph node dissection and radiation therapy, 15 to 30% reported impaired range of motion at five years following treatment. So that's pretty far out. And 30 to 40% reported pain at five years. Again, five years is a long time after treatment, and relatively high percentage of women reporting impaired range of motion and pain. Now if we look at those two treatments independently, axillary lymph node dissection and radiation, you can see the odds ratios here for developing symptoms.

3.3 for the axillary lymph node dissection and 3.1 for the radiation therapy. So again, understanding what your client has been through or what they're going through and understanding how their treatments may be influencing perhaps a shoulder impairment in this case. So this study, I thought, was really interesting. It's a little bit older, it's from 2007, but this study looked at sensations following sentinel lymph node biopsy versus axillary lymph node dissection. Now, remember, the sentinel lymph node biopsy is just when one or two or three or so lymph nodes are removed. The axillary lymph node dissection is much more invasive. So just to orient you a little bit to this table in front of you.

So along the left hand side, you've got various sensations. And then the next four columns are the prevalence of those sensations following either sentinel lymph node biopsy or axillary lymph node dissection. And then the next four columns are severity. So women were not just reporting the prevalence of the symptoms, but also the severity. The baseline numbers are just following surgery and 60 months, or five years, is five years following surgery. So I just wanna draw your attention to a few of these sensations now. So the sensations that have the asterisk, asterixes next to the sensations or next to the percentage indicates that the number is statistically, significantly different compared to the sentinel lymph node biopsy. So here we have the sensation of tight.

And you can see, 82% of women reported tightness following axillary lymph node dissection, just following surgery. And at five years, 47%, so close to 50%, we'll say, we'll round up a little bit, were still experiencing tightness following an axillary lymph node dissection, five years later. Similarly, maybe just using a synonym here, almost 80% experienced stiffness following surgery. Now going down, we'll also look at numbness as a sensation. So 83% experienced numbness following axillary lymph node dissection. And 55% still were experiencing numbness five years later following the axillary lymph node dissection. And this was the only statistically significant

difference here in terms of severity, but women rated their numbness as more severe following axillary lymph node dissection postoperatively as well. So I think this is important to help us inform our patients a little bit. These patients come to us with a lot of questions. And the number one question is, is it always gonna be like this or is it going to get better or is the numbness always gonna be there? It is always gonna feel stiff? And I think the answer that a lot of these women are given by their surgical oncologist is sort of the politically correct answer of, everybody's different, we're gonna have to wait and see, time will tell, yada yada. And there's some fairness to that statement because everybody is different and it does take time. But I think if we can use the information even just outlined here in this table to help us educate the patients a little bit more.

So when she says, is this area gonna be numb forever? Rather than just saying, everybody's different, if we can confidently say, well, there's been some research that has actually shown about half of women still experience numbness several years following surgery. With that said, we do have to kind of wait and see. Everybody's different, so I kind of pepper in the PC answer in there as well. But again, using this to help us have more informed conversations with our clients. Okay, so let's talk a little bit about body structure and impairments that we may see. I apologize for this big armpit in your face, but this armpit is where we see a lot of these impairments arising from, so we're gonna use this sort of as our canvas. So scar tissue and adhesions. So I mentioned earlier the axillary lymph node dissection scar, which you can see in the top red line here. That's a common location for it in the armpit. It can be an area of a lot of scar tissue restrictions, even just pain surrounding that scar. The red line that you see a little bit further down the chest wall. Oftentimes, there's a scar here either from the breast surgical procedure itself or oftentimes, there are drains that are placed postoperatively, and the drains result, the removal of the drains, I should say, result in an accumulation of scar tissue there, which can also be restrictive and painful. Women can sometimes develop what's called an axillary web syndrome, or cording. So you've

seen some additional lines now come onto this armpit here. And so what we see oftentimes arising from the scars related to either the breast surgery or the drains or the lymph node procedure, is we see cording. And what cording is really believed to be is lymphatic structures which are more prone to fibrose, become very tight, and they can actually protrude. They can be visible cords. They can be painful. They can be felt not just in the armpit, but even down into the antecubital fossa and down towards the forearm and the wrist. And this can really restrict movement and restrict function because of the pain. I talked a lot about soft tissue and muscle imbalance. But this can certainly lead to or contribute to impaired posture, impaired rib cage mobility. Again, working through the layers. This can all then influence the scapulohumeral rhythm. So sometimes these women, on the outpatient side of things, will actually be referred for really an impingement pain, maybe a subacromial impingement or a supraspinatus tendinopathy or even a tear, in more severe cases. And because of the soft tissue and the muscle imbalance that we're seeing, the tight, shortened structures in the front, the weak, lengthened out, passively insufficient structures posteriorly, we see an impaired scapulohumeral rhythm resulting in a functional impingement. And we may also see lymphedema.

So I added that in here at the body structure and impairment level, excuse me. But as a result of lymph node procedures or maybe the radiation therapy, we may see a development of lymphedema, or swelling in the limb, which can certainly contribute more to functional impairments. So what does my evaluation typically look like for these women? So oftentimes, they're referred for range of motion issues. So I'm certainly going to look at active and passive range of motion, trying to differentiate whether this is an issue of strength or whether this is an issue of soft tissue restrictions, scar tissue and adhesions and muscle imbalance limiting even passive range of motion. Looking not just at quantity, but also the quality of movement. Looking for compensatory movements, hiking the shoulder, too much upper trap activation. Oftentimes, I'll get a subjective pain or even a tightness or a stiffness score. So

sometimes, these women will not experience frank pain or not experience pain at rest. They'll only experience their symptoms when they are reaching their arm out to the side or up over their head. So as they go through their active range of motion, I'll say, "Okay, you're at your end active range of motion. "How much tightness do you feel right now, zero to 10? "Or how stiff is that zero to 10 "or how painful is that zero to 10?" And I'll get a starting measure for that subjective sensation. So then we can look back in a couple weeks and say, okay, maybe you've got the same range of motion, but your stiffness score has gone down from a seven to a three. Or we've got better range of motion and your tightness score has gone down from a five to a one or your range of motion has, you've gotten 30 more degrees, but your tightness is still really high and maybe that's leading back to that table where women still experience tightness and stiffness.

So again, just measuring at baseline so then you can see if the sensation is correlating with the functional and objective changes. I mentioned taking qualitative, or making qualitative observations of movement. Certainly that may be leading to functional impingement. Looking at strength, manual muscle testing or functional strength testing. Again, seeing if that is the limiting factor. Focusing perhaps on those posterior structures that I said may be passively insufficient and stretched out. So testing the middle trap, the lower trap, the rhomboids, the scapular retractors, seeing how much work you're gonna have to do to strengthen those muscles to get those scapula in better alignment.

Doing a postural assessment, so however you wanna do that, whether that is a Reedco Posture Score or just observationally, or sometimes what I'll do is, I'll measure in centimeters typically from the superior angle of the scapula to, say, the spinous process of C7 and see what the difference is from one side to the other. You may find that the side that has had the surgical procedure or that has had the radiation therapy is more protracted, and therefore is a longer measurement from C7 to superior angle.

Any way that you can think to objectively measure posture so that you can then track that as you go along. And then, really, the key here, I think or one of the most important parts of the evaluation is the soft tissue and fascial assessment. So seeing the impact that it has on the range of motion, on the strength, on the posture, and the quality of the movement. But then really getting into the surgical area, the postsurgical area or the radiation field and seeing what is restricted. So working through the axilla, feeling through and looking at the anterior and lateral chest walls, feeling through the sternum. This can be an area of a lot of fascial restrictions in between the two breasts. And looking at the chest wall and all the muscles associated with both the scapula and the humerus.

So not just looking at the pec major and pec minor, which, as I mentioned, are likely angry, but also feeling through the serratus anterior and the subscapularis and the rotator cuff muscles. The upper trapezius, oftentimes because it's hyperactive and kicking in as a compensatory muscle, can be tight, can be painful, can even cause neck issues, which is a different lecture, sorry. But really being comfortable feeling through this region of the body and assessing with your hands. For the male therapists who are watching and listening, this is something that may be uncomfortable at first, so certainly draping appropriately and doing whatever you need to do to approach this confidently.

The more comfortable you are and the more confident you are in your evaluation and in your manual technique, the more comfortable this patient is going to be in your hands and the more effective your treatment will be. There have been some outcome measures that were recommended by a task force, actually, that was developed by the, at that time, Oncology Section. We're now known as the Academy of Oncologic Physical Therapy. But the Oncology Section back in 2013 developed a task force to look at outcome measures for upper extremity function in breast cancer survivors. And here are the four recommendations that they make. The DASH, the first one on the list,

the Disabilities of the Arm, Shoulder, and Hand is the outcome measure that I typically use most often. In fact, I think I use it with almost every patient who I'm seeing for shoulder dysfunction due to breast cancer and breast cancer treatment. It does a really nice job of covering ADLs, also getting subjective scores for pain, any neuropathic changes. It asks about tingling, asks about weakness and stiffness. There are also work subscales and sports or recreational subscales as well. The DASH is the one I typically go to, but here are the four that are recommended. So once we've done our evaluation, what do we do? What are our interventions? Well, myofascial release, manual therapy has been found to be effective to decrease pain intensity in the upper extremity for these patients with shoulder dysfunction due to breast cancer treatment. So manual therapy is a big part of it, and exercise is the other big part of it. Exercise has been found to result in significant and clinically meaningful improvements in shoulder range of motion.

So just to kind of walk you through my interventions and sort of my approach here. As I mentioned, myofascial release and manual therapy, scar tissue mobilization is a big part of this. That stiffness sensation, that tightness sensation can come down significantly with manual therapy. No real special techniques, but your typical manual therapy. The myofascial release, you know how to do the soft tissue mobilization to the chest wall musculature and the associated scapulohumeral musculature that you know how to do. Active and passive stretching is a big part here, teaching the patient how to perform their own stretching. Working from active assisted range of motion, maybe in more supportive or more supported positions like supine or even up against a wall or sitting. Working more towards active range of motion, focusing on quality of movement, focusing on that scapulohumeral rhythm. And then progressing to progressive resistive exercise as long as there's no contraindications because of bone integrity due to the cancer having metastasized to the upper extremities. Progressive resistance exercises, either with TheraBands or free weights or body weight is typically the progression there. Postural re-education is a big part here. So I've talked at length

now about the potential impacts that the treatments can have on posture. We can do all the manual therapy and myofascial release that we want, but then if that patient is going and sitting at a computer for eight hours and they're falling into a rounded, forward-flexed position, you better believe everything's gonna tighten back up. So really focusing on postural re-ed, strengthening the posterior musculature, the scapular retractors, and really teaching the patient about the position that they need to be in or should be in. And neurological re-education is a big part here. So not just optimizing shoulder range of motion, glenohumeral range of motion and saying, okay, that's it, not just strengthening the supraspinatus and the deltoid or the biceps and saying, okay, that's it, but really reintegrating the arm and the shoulder into this patient's movement pattern.

So whether that is gait training and focusing on reciprocal arm swing or whether it is a reaching task, getting the contralateral multifidi and gluteus maximus to fire at the same time as the shoulder flexion. Think about how to reincorporate and reintegrate that shoulder, that arm back into that woman's movement pattern. A couple notes here just about exercise and aromatase inhibitors. So remember, I mentioned aromatase inhibitors have their own class of side effect, now aromatase inhibitor-induced arthralgias, which can be really distressing for these women who are forced to be on this hormone therapy for several years following treatment. This study in 2018 looked at aerobic and resistance training in both healthy post-menopausal women and women on aromatase inhibitors.

And they found similar improvements in lower body strength, VO2 max, and body fat mass. And I note that I'm sort of squeezing this in as I'm talking about shoulder dysfunction, but I wanted to talk about exercise and how it can be used to mitigate some of the side effects of hormone therapy, of the aromatase inhibitors. The interesting conclusion that these authors drew from this was that, okay, we deliver the same prescription of exercise to both groups, both healthy post-menopausal women

and women on aromatase inhibitors, and we saw similar improvements in both groups. Maybe we don't need to be changing the way that we deliver exercise, at least to these groups in response, or in the context of hormone therapy. So I thought that that was an interesting conclusion to draw there. But underline, exclamation point here is exercise is good, no surprise there. So just to summarize here. We have to understand what has been done surgically in regards to shoulder impairment. We should communicate with the surgeon regarding potential precautions, and that's depending on if we're seeing them bedside or if we're seeing them on an outpatient basis, how far out they are, excuse me, how far out they are from surgery, if they're in the window for any potential precautions. We have to understand the impact of adjuvant treatments, whether that is radiation therapy, hormone therapy, or chemotherapy. Understanding where sort of the window of the side effects are also that they may be experiencing. Be confident in educating your patients. The more confident you can be in educating your patients, the better your rapport will be with that patient and, obviously, the better your outcomes will be.

And there's a movement towards prospective surveillance in breast cancer survivorship. And I just wanted to mention this. Nicole Stout has done a lot of work regarding prospective surveillance. And the concept is, basically, how can we get in to see these patients earlier and earlier and earlier to get a baseline to screen for functional impairments to catch them at the earliest possible point so that we can initiate earlier intervention and really prevent a lot of those chronic, longer term, more severe side effects in regards to the radiation fibrosis? And sort of the whole cascade of effects that can occur down the line. So I think there's gonna be more about that in the months and years to come, probably with some guidelines as well. Okay. So now we'll work through a quick case study here. So this patient is a 47-year-old female diagnosed with stage II left-sided estrogen receptor-positive invasive ductal carcinoma, now status post left total mastectomy, which remember is removal of all the breast tissue as well as the skin and nipple, with sentinel lymph node biopsy and immediate

reconstruction with TE, with the tissue expander. Referred to PT for decreased range of motion. Now according to the patient, she will not require chemotherapy. That's great. She was started on Tamoxifen, which remember is one of those hormone therapies, following surgery and is meeting with a radiation oncologist this week to discuss initiation of XRT, or radiation therapy. Okay, so just to lead you through my thought process a little bit, if I were to come across a patient like this. So the first thing I wanna know is, when was surgery? What was the date of surgery? Are we in a window where there may still be postoperative precautions that we have to work around or work within the confines of? Is there a planned date for exchange for the tissue expander, for the permanent implant? The fact that she's talking about initiating radiation therapy, my guess, my assumption would be that the exchange won't be until after the radiation therapy.

But if we need to be working in the context of anticipating another surgery, another procedure, I'd like to know that from the get go so we can plan accordingly. I wanna know what her dominant hand is. So if she had this surgery done on the left side, is she left handed or is she right handed? That's certainly gonna impact the functional impact of this surgery and this treatment. Thinking about Tamoxifen, different side effects we may see there. Remember our increased risk of blood clot, increased risk of bone loss. So thinking about how that may impact your evaluation. It's easy to screen for a blood clot, but maybe your senses are just a little bit heightened now looking for it. And I wanna know what the functional impact is. What has she been having trouble doing?

So I'm gonna ask just that question. What have you been having trouble doing? Are you having trouble doing your hair? Are you having trouble getting dressed? Are you having trouble bathing yourself? Are you having trouble reaching to high shelves and cabinets? Or what does she do for work? Is she working and is it impacting her there? What kind of exercises was she previously doing, if any, and is she able to do them again or does she need our help to get back to her regular exercise plan? I do wanna

know if she's currently doing exercises. At Memorial Sloan Kettering, women postoperatively are given postoperative exercises in a packet. Sometimes they are enough to get a woman up and running in terms of shoulder range of motion, sometimes not. So I wanna know if she is doing those exercises, and if she does, are they helping? That's gonna give you a little bit of a hint about whether stretching, whether at least she perceives stretching and exercise as beneficial. Lets you know where you're starting from. For my evaluation, she's referred for decreased range of motion so gonna look at range of motion, active and passive. Gonna palpate through that area, through the chest wall, the axilla, the sternum. See what's tight, see what may be limiting range of motion. In terms of goals, I'm certainly gonna be setting goals for range of motion. If strength is limited, gonna be setting strength goals. Maybe setting some goals based off her subjective experience of tightness or stiffness.

And as for my first session plan, probably gonna start with manual therapy, myofascial release, soft tissue mobilization. Working to optimize the passive range of motion, teaching her how to do some stretches, whether it's like a countertop latissimus dorsi stretch or even just child's pose stretch like a quadruped, rocking back onto the feet, stretching the arms above the head or working in supine, active assisted range of motion, working through shoulder flexion either with a cane or with hands clasped and then progressing from there. Thinking about scap squeezes, activating scapular retractors. Okay, so that's it for shoulder impairment. If you have any questions about this case or anything related to shoulder impairment, feel free to plug in your question now or we'll get to them at the end. So now we're gonna move on to talk a bit about chemotherapy-induced peripheral neuropathy and how that relates to balance and falls following treatment for breast cancer. Chemotherapy-induced peripheral neuropathy is not unique to only breast cancer and breast cancer treatment. But it is a common side effect of several of the chemotherapies that are utilized to treat breast cancer. So I wanna talk about it in the context of breast cancer. So chemotherapy-induced peripheral neuropathy, or CIPN, which is much easier to say. CIPN is relatively

common, potentially a severe side effect of chemotherapy. It typically impacts sensory nerves first and more severely compared to motor nerves. Neuropathic symptoms can vary. So the patient may experience numbness or tingling or pain, itchiness or burning or cold. It can sort of run the gamut. And comorbid conditions can predispose patients to CIPN. So any underlying etiology that may have predisposed that patient to a peripheral neuropathy, whether it is diabetes or even alcohol abuse can actually increase the risk of developing a chemotherapy-induced peripheral neuropathy. So in terms of prevalence, as I mentioned, there's some chemotherapeutic agents that are more prone to cause CIPN. And so the sort of classes of chemotherapy are the platinums, which I mentioned before, taxanes, which Taxol falls into the taxanes category.

You'll recognize that with a T-A-X, the tax. And then vinca alkaloids is another family, and you'll recognize any vinca alkaloid because it will have V-I-N in the name, like vinorelbine is one example there. No need to memorize that, but know that there are some classes, these three in particular, that are more prone to cause CIPN. This study in 2016 found an aggregate prevalence of CIPN to be 48%. And the prevalence in the first month following chemotherapy as high as 68.1%, and then there's a bit of a natural history where six months following chemotherapy, 30% of patients were experiencing CIPN. So still a relatively high number, 30% six months following chemotherapy.

So similar to how side effects may rear their ugly head following treatment with radiation therapy, it can be similar with chemotherapy where, actually, there are cumulative, there's sort of a cumulative effect through a course of chemotherapy where maybe just towards the end of the chemotherapy, the patient may start to experience symptoms related to CIPN. Sometimes it can even just occur following the termination of chemotherapy, and there can actually be a coasting effect where then those symptoms do persist following the termination of chemotherapy. So what does this

look like? What does CIPN present like? So typically, CIPN is symmetrical. So if you have a patient with just neuropathic symptoms on one leg or in one arm, CIPN can be in your differential diagnosis certainly, but you may need to think about different diagnoses, whether it's a brachial or a lumbosacral plexopathy or a mononeuropathy due to radiation or something else going on. It does present in a stocking glove or distal to proximal presentation, both in the lower extremities and upper extremities. As I said, the paresthesias can vary. So they're sort of classified into two categories, positive symptoms, not meaning good symptoms, but positive symptoms meaning symptoms that are, or sensations that are added to the situation. So the patient may experience burning, tingling, itching, or pain, as I mentioned, versus negative symptoms. In other words, paresthesias or sensations that are removed from the situation. In this case, numbness. And the patient may experience impaired balance so that's what we'll talk a little bit more about here. So increased risk of falls. So take away CIPN for a moment, okay? Forget we're talking about CIPN. In cancer survivors, again, not talking just about peripheral neuropathy, but cancer survivors have been shown to have up to two times the fall rate compared to their cancer-free peers.

So that's a pretty big fact there. Think about that patient walking to your clinic, regardless of what type of cancer they have survived, understanding that they may be at increased risk for falls. And then we add those CIPN symptoms, the numbness, the tingling, the pain, whatever it may be. And several studies have shown a further increase in fall rate, 1.8 to three times the fall rate compared to their cancer survivor peers without CIPN symptoms. So this can certainly increase the risk for falls. Now, functionally, what does CIPN look like? How does it rear its ugly head in addition to the increased risk of falls? So certainly increased risk of falls is a big functional implication. The subjective positive symptoms, so the symptoms that are being added, the burning, the tingling, the pain, can certainly impact quality of life. Oftentimes, that's the patient's chief complaint. They may be referred for impaired balance or increased falls, but the patient comes in and says, yeah, my feet hurt, or my feet are burning, my feet are

tingling and it's keeping me up at night. I find that oftentimes because of the stocking glove distribution, these patients have an altered center of gravity or altered weight bearing, almost a reluctance to shift weight anteriorly onto the toes, onto the balls of the feet, focusing just on the lower extremities now, which we'll do for the rest of this discussion. But a decreased anterior weight shift resulting in a posterior center of gravity, a posterior weight bearing. And certainly that can present to impact functional transfers, ambulation, and stair negotiation. So what's my evaluation gonna look like for these patients? So oftentimes, they're referred for impaired sensation, so I'll do some sensory testing. I'll probably do monofilament testing to test light touch, protective sensation. Is sensation so impaired that we need to really teach these patients about doing foot checks, proper footwear? We may need to. And then testing proprioception or even vibration, or vibratory thresholds. If the patient does have impaired balance, perhaps it's more because of a proprioceptive impairment. Looking at ankle range of motion and strength.

So because of that difficulty weight shifting anteriorly, I find that almost always, ankle dorsiflexion range of motion is limited. So I'll measure ankle dorsiflexion range of motion, sometimes strength, if this is more of a chronic issue or if it's more of a severe peripheral neuropathy that has impacted motor neurons. That makes for a really good easy objective measure that you can then set a goal of if the patient is lacking dorsiflexion range of motion. Set a goal to improve dorsiflexion range of motion, to improve foot clearance, to improve initial conditions for sit to stand transfers, et cetera. Certainly testing balance. Even if the patient's chief complaint is not I'm off balance or I'm falling, looking both at static balance, looking at dynamic balance and seeing if that patient is indeed at fall risk. And last but certainly not least, doing a thorough evaluation of gait and functional transfer assessment, seeing how CIPN is manifesting through functional movements. And so, we've got a video now. So this is me doing my best impression of a patient transferring sit to stand with the impact of chemotherapy-induced peripheral neuropathy. So again, I'm doing an impression. I am

gonna exaggerate it a little bit, but I'll point out sort of the things that I look for as I am objectively looking at this transfer, and how I may evaluate the patient. So if we can go to the video now. I'll press play. Okay, so I start by looking down at the feet, okay? Start down at the floor. So you can see right away my posterior center of gravity. Toes coming up off the floor, that's a common thing that you'll see, and that's an easy thing to see. You also see with the posterior center of gravity, the legs bracing on the edge of the bed as I stand up. A big use of momentum on the way back up. And on the way back down, decreased eccentric control sort of resulting in the plop there. Okay, I'm just gonna make you guys watch me one more time.

So again, looking at the quality of the movement. Clearly a posterior center of gravity. I may be exaggerating here a little bit, but these are the components of a functional transfer that you can look for with a patient that you may see. Decreased anterior weight shift. Not getting my nose over my toes. Not in a proper way, at least. Okay, great, so we'll go back to the slide. Okay, perfect. Okay, so looking at functional transfers. So if you're using, say, a test like the 30-second Sit-to-Stand or the Five Times Sit-to-Stand, certainly that can be a good objective measure to get a number of repetitions of standing up and sitting down, but really qualitatively looking at what impact the CIPN is having on that patient. Okay, so then very similar with gait assessment, and similarly, again, this is me demonstrating a typical gait, which we'll now see in the video if we can go to the video.

Okay. So here are the things that I look at. Let's start down at the ground again, okay? So you see a short step length, wide base of support, almost no anterior translation of the tibia over the foot. Again, that may contribute to limited dorsiflexion range of motion. Good objective measure for you. Moving up the chain, pretty stiff knees. Really lacking hip extension through terminal stance. I'm gonna play this again for you guys. I know I am on a treadmill, but I'm walking slowly, intentionally. Gait speed is often decreased in patients with CIPN. Patients with CIPN take on what's referred to in

diabetic peripheral neuropathy as a conservative gait pattern. So you can see here, and I'm actually, probably not intentionally, but I actually am looking down at my feet as I'm walking here. I'm gonna give you a little bit more. I'm looking down, which is pretty common as well either because of altered sensation or decreased proprioception. Oftentimes, these patients will rely on visual cues to make sure that they have their footing and they're not tripping. Okay, that's my best CIPN impression. Okay, so let's go back to the slide. Okay. So looking at transfers, looking at gait. In terms of outcome measures, the Oncology Section also had a task force looking at breast cancer outcomes for balance. And here are their recommendations. So the Fullerton Advanced Balance Scale. The TUG test is quick and easy. That's a quick screen for increased fall risk. The 10 Meter Walk Test I almost always use to get gait speed.

Again, gait speed, they talk about it being a vital sign. It's quick, it's easy to do in the clinic, it has cutoff scores for age matched norms for increased fall risk or safe community, safe household ambulation. So that's a quick and easy one that I almost always do. And it's also an objective measure that I find almost always improves with treatment as well. And I mentioned the Five Times Sit-to-Stand. Then we've got different static balance tests. So whatever you're most comfortable with, whether it's tandem stance or single-limb stance, sort of whatever's most appropriate for that patient. The modified CTSIB. So putting them on a compliant surface, having them close their eyes, rely a little bit more on their vestibular system, see if that system is up to snuff. The Romberg with eyes closed is quick and easy. The Neuropathy Pain Scale. So this is a patient questionnaire that looks at a little bit more, asks a little bit more about those positive symptoms. So it's a 10-item questionnaire, and it asks things like, how deep is your pain? How superficial is your pain? How hot or cold, how sharp or dull? And then that can just get a little bit better of an objective measure of the patient's subjective pain. So it gives you something to track along the way as well. So what do we do for these patients? So we do utilize desensitization for the positive symptoms. So my first session usually entails teaching the patient how to, and I

performing some desensitization massage either using hands or a towel or another cloth, sort of progressing from a very soft texture to a rougher texture, introducing different textures. That can be helpful, even transiently, to decrease the pain, the tingling, the itching, the burning. Starting with proprioceptive training at whatever level is most appropriate for the patient. So maybe having them start in sitting doing a wobble board or a BAPS board or just working through ankle range of motion, working up to standing and weight shifting and really kind of reintroducing the four corners of the feet, to kind of steal a yogi term. And then progressing from there onto compliant services, closing eyes. Working through balance training, static balance, progressing from wider base of support to more of a narrow base of support. Working from static to dynamic, obstacle negotiation, varying surfaces, curbs, ramps, whatever that patient's gonna be encountering out in the real world. Gait training, of course, is a big part here. Working really to combat that reluctance to anteriorly weight shift.

Working on getting that anterior translation of the tibia over the foot. Getting that hip extension and glute activation, getting push off. And I find that, oftentimes, just through changing those components of gait, gait speeds up, which is a really nice outcome. And I don't intend to list this as the last thing here on this slide, meaning chronologically. It's a thing of last resort. So I mentioned assistive device assessment and prescription here. These patients are oftentimes at increased risk of falls, as I've outlined. If you screen and deem them at increased risk of falls, you gotta do something about it before that patient leaves the clinic on that very first day. So whether it's educating a caregiver or a spouse or a partner, educating the patient, certainly, or assessing and prescribing and providing, in some cases, if you're able to, an assistive device. So I just wanna share one of my go-to interventions here. It's a treadmill push. So we can go to the video. And what you're gonna see here, actually, the treadmill's not on. Rather, it's off, but I'm holding anteriorly and I'm just using my feet to push the tread. And so I really love this. I don't reserve this just for higher level patients that you might think to use a treadmill with. I'm gonna play this a couple times.

I can use this even for lower level patients. It's really kind of forcing the issue of that anterior weight shift. The patient has support anteriorly, so they typically feel secure. And you can really kinda slow things down and cue them to get that glute activation, get that hip extension, that push through and that push off at terminal stance. The treadmill does this kinda nice little rev up sound as they push off, so they can sorta use that as their self cue. So you just rev, . So this can be nice, and then obviously, translating this from on the treadmill to then practicing over ground to make sure that those changes are translating. It's one of my go-tos there. Okay, so let's go back to the slide. Okay. So just to summarize here. So we have to understand where the patient is in their chemotherapy journey.

So remember, chemotherapy can be cumulative when it comes to CIPN. So are they towards the end of their chemotherapy dosage or even just after? Remembering that some of these symptoms can coast and can last beyond chemotherapy. The patient's subjective positive symptoms may be the most distressing. And this can be a difficult situation because functional improvement may or may not correlate with the subjective experience. I can't tell you how many times I've seen patients, and at the end of our course of therapy, I say, "Wow, look at this. "You're walking faster, you're standing up better, "you're balanced better, "you can stand on one foot 30 seconds. "You're doing cartwheels," et cetera, et cetera. And the patient says, "Yeah, but my feet still hurt. "Yeah, I can't sleep 'cause my feet are itching all night." And that can be tough because, to sort of rely on that politically correct answer again, a lot of this is time sensitive.

And oftentimes, it just does take time for those subjective symptoms, for those positive symptoms to improve. And obviously, prioritizing safety and fall prevention. These patients, and cancer survivors in general, are at increased risk for falls. So making sure to screen for that and then triaging or managing the situation as necessary. So we'll go through a quick case study here for CIPN. So this patient is a 55-year-old female one

year status post right sided total mastectomy and axillary lymph node dissection, and she's after six months of chemotherapy, ACT. Patient is now considered NED, which is no evidence of disease, best case scenario, obviously, and is referred to PT for peripheral neuropathy and gait training. The patient's chief complaint is burning pain, especially at night. Okay, like I just sort of said can be the case. So off the bat, first thing I wanna know is what is ACT? Okay, so I mentioned chemotherapies are not often used just as one single agent, but oftentimes as a cocktail or a combination, so that is the case here for ACT. ACT stands for Adriamycin, Cytoxan, and Taxol. The T stands for Taxol. And remember, Taxol is that one that oftentimes results in peripheral neuropathy.

So maybe that is sort of what we're pointing out finger at here in terms of what has caused this peripheral neuropathy and gait dysfunction. I wanna know if there are any comorbidities. Remember, diabetes or any sort of predisposition for a peripheral neuropathy may compound or may predispose this patient for developing CIPN. I wanna know when the patient's symptoms started. So is this something that was there that was present before surgery, before chemotherapy? That's gonna be a different picture as compared to whether the symptoms started just towards the end of chemotherapy or even after the completion of chemotherapy. Sort of in that same line of questioning, I wanna know, are her symptoms changing? So presumably, now we're past chemotherapy.

Are symptoms getting better? Are they getting worse? Sort of naturally which way are things going? That's gonna help you develop your rehab prognosis and sort of your ability to think about how quickly you make some changes. I wanna ask if this patient has had any falls. So we know that they're at increased fall risk from the cancer piece alone, and now with CIPN, that further increased risk of falls. So the patient's chief complaint is the positive symptoms, but have they noticed their imbalance? As far as my evaluation goes, gonna do some sensation testing. Almost always gonna take an

echo dorsiflexion range of motion and strength measurement, functioning looking at transfers and walking as we did in the videos, and then testing static and dynamic balance, whichever measures you like to use. Have to ask ourselves, is an assistive device appropriate for this patient? A 55-year-old female doesn't typically fit the mold of somebody that we may recommend a cane or even a walker for. But in this case, might that be a temporary support that we need to prescribe for this patient, that we need to recommend for this patient to utilize to minimize risk of falls?

As far as goals go, if dorsiflexion range of motion is limited, I'm almost certainly setting a goal off of that to improve foot clearance, decrease risk of tripping or catching toes on stairs. Gait speed is a great goal to set. And as for my first treatment session, particularly if the patient's chief complaint is this burning pain, the positive symptoms, going to start with some desensitization massage. I will provide some, and in doing that, I will teach the patient how to do some of that desensitization massage themselves so that hopefully she can use it. Even if they only get transient relief, if it's enough to relieve that burning pain to get to sleep at night, that can have a great impact on quality of life. Okay. So lastly here, and I'm sorry, if there are any questions in regards to CIPN or with this case study, please type them in and we should have a few minutes at the end here for questions.

So last thing we'll talk about before the end is upper extremity lymphedema following treatment for breast cancer. So lymphedema, similar to CIPN, actually, is not unique to breast cancer and breast cancer treatment. Lymphedema can occur with various different cancers and different treatments for different cancers. But we'll talk about it in the context here of breast cancer and its treatment, as it is one of the more common survivorship issues related to breast cancer. Now as I mentioned at the beginning, I am not a Certified Lymphedema Therapist. With that said, it's really important that, even as a non-Certified Lymphedema Therapist, you're familiar with lymphedema, risk factors for developing lymphedema, and ways that you can educate your patients to minimize

their risk or reduce their risk for developing lymphedema. So first and foremost, what is the lymphatic system? This is not a system that we all learn about in PT school. So the lymphatic system is part of the immune system. It's similar to the circulatory system, except that it doesn't carry blood, it carries lymph. And lymph is actually a clear fluid. It's a protein-rich fluid that carries white blood cells. So you can see in the diagram to the right, the green is the lymphatic system.

So you can see it is similar to the circulatory system in that it has vessels that run throughout the body. The vessels are much thinner, much finer than our circulatory system. And there are also some organs that are associated with the lymphatic system, and those organs are the tonsils, the thymus, the spleen, and the liver is considered part of the lymphatic system as well. So normal lymphatic flow. Again, I'll reiterate, this is what we expect to see in an intact, normal lymphatic system. As blood circulates throughout the body, lymph leaks out from blood vessels into surrounding tissues. Again, that's normal. Lymph then carries food to cells and then it cleanses the cells. It collects waste products, bacteria, dead or damaged cells, and then that fluid normally drains back into the lymph vessels, proceeds on to the lymph nodes, which are sort of the filters of the lymphatic system, and then makes its way to the larger lymph vessels, eventually making its way to the thoracic duct at the base of the neck and returning back into the blood circulation.

So again, this is what we expect to see in a normal system, in an intact system, that the lymph does leak out from blood vessels, but then makes its way back into the lymphatic system and eventually back into the blood circulation. Lymph nodes, as I mentioned, act as filters. So lymph nodes are sometimes thought of as the toll booths of the lymphatic system. They're found in clusters. So the big clusters are found in the neck, in the armpits, in the mediastinum down the front of the chest, through the abdomen, in bilateral sides of the groin and the pelvis. So in regards to breast cancer and breast cancer treatment, we've mostly been talking about the clusters of lymph

nodes in the armpits, or in the axilla. Remember in regards to the axillary lymph node dissection or the sentinel lymph node biopsy. So how does lymphedema develop? Well, when the lymphatic system is damaged or disadvantaged, just to use another word, lymph fluid can accumulate in limbs or other parts of the body. And that damage or disadvantage to the system can come due to lymph node removal, cancer involvement in lymph nodes, as well as radiation field including the lymph nodes and the vessels. So what are some characteristics of lymphedema? Well, lymphedema typically is slow at onset. It's slow to progress, but it is progressive. It's typically a unilateral or asymmetric swelling. So another point of differential diagnosis here, if you have somebody who has bilateral swelling or bilateral symmetrical swelling, lymphedema can certainly be in your differential diagnosis, particularly if the lymphatic system has been damaged bilaterally. But you may need to think about other potential causes of that swelling, whether it's cardiac related or more of a systemic issue. Patients often describe lymphedema as a heaviness, as a fullness, sometimes it can be an achy pain.

Patients may experience clothes or shoes or rings fitting tightly. So sometimes, if someone develops a unilateral swelling, they may notice that their right sleeve feels tight or the ring on their left finger feels tight. Those can be some good screening questions for you. It can present as weakness. So anytime a limb is edematous, it is bigger, it is heavier. And if the muscles are not equipped to manage that increased weight, that can present as weakness. The patient may have enlarged pores in the area of lymphedema. So this picture of the orange peel's been sitting down there and that's what this is in regards to. Patients can develop what's called an orange peel appearance. So if you look at sort of the dimpled texture of an orange peel, that's actually very similar to what the appearance can look like in an area of lymphedema with enlarged pores. So again, even not as a Certified Lymphedema Therapist, if you're working with a patient and you're seeing this area that may or may not be swollen to the naked eye, but you're seeing these enlarged pores, this orange peel appearance,

that can be one indication that there may be something going on underneath. It can present as pitting edema as well. And so lymphedema does progress through stages. So stage zero, or another term for stage zero is subclinical or a latent stage of lymphedema. Swelling is not evident, despite impaired lymph transport. So in each one of these four pictures, we are looking at the left arm, the patient's left arm, or the right arm on the picture, or the right side of the picture, I should say. So stage zero, this latent stage can last for months or even years before progressing on to stage two, or, I'm sorry, stage one. I jumped the gun, stage one. So stage one is considered a mild stage where swelling is still gravity dependent. So that is to say, if a woman is experiencing swelling in one arm, if she elevates that arm, the swelling will reduce, it's gravity dependent. We may or may not see pitting occur here. And then stage two, so stage two is more of a moderate stage swelling, where the swelling is now no longer gravity dependent.

So if this woman is experiencing this kind of swelling in her left arm, even if she elevates the arm, that may not reduce the swelling. We may start to see tissue fibrosis during this stage of lymphedema. And hopefully not, but lymphedema can progress further to stage three. So stage three, as you can see in the picture, is more of a severe stage. We see trophic skin changes at stage three. Fat begins to be deposited, underlying the lymphedema, which can be a very big issue here.

Because even through lymphedema therapy, if the lymphedema therapist can get the lymphedema, the swelling to decrease, if fat has been deposited or if tissue fibrosis has developed underneath the swelling, that tissue fibrosis or that fat, sometimes called lipedema, may not respond to the same compression or the same bandaging, the same lymphedema therapy that's been provided, and that can certainly go on to restrict movement and really impact function. So there are some relative risks of the treatment factors that we've talked about. So looking just at mastectomy versus lumpectomy, mastectomy does have an increased risk of that patient developing

lymphedema. Axillary lymph node even more so. Sorry, axillary lymph node dissection even more so. You can see the relative risk is 3.47. The axillary lymph node dissection versus the sentinel lymph node biopsy having an increased risk as well. And radiation therapy also does increase the risk of developing lymphedema. So underscoring the importance of understanding exactly what your patient has had performed, excuse me, has had as part of their treatment for breast cancer will also help you sort of form your hypothesis or your expectation of sort of what kind of relative risk group they're in. So risk factors for lymphedema. So we talked about breast cancer itself, breast cancer treatment, surgical lymph node removal, and radiation to the lymph nodes. There are some other risk factors for developing lymphedema, and this is a modifiable one. Obesity or weight gain following diagnosis actually increases the risk of developing lymphedema. Injury, infection, and trauma to the affected limb or the body area can increase the risk for developing lymphedema, And we have to change a little bit our traditional thought about an injury or trauma and understand that it can be something as minor as an insect bite or a sunburn or even muscle overuse.

Really, anything that can lead to an infection or that can lead to inflammation, that leads to swelling and increased blood flow and fluid transport to that region of the body, if the lymphatic system is disadvantaged or not able to reabsorb that lymph fluid in the same way that it usually can, that can lead to the increased risk of lymphedema. Increased age, certainly not a modifiable risk factor, but is a risk factor for developing lymphedema. And heat and ice modalities. So this is on here for a similar reason as the inflammation and the danger of an injury or trauma that I just mentioned. Heat, through vasodilation, increases blood flow, increases fluid transport to a region of the body, and if the lymphatic system is not able to reabsorb that lymph fluid, that can increase the risk of lymphedema. Ice, sort of on the flip side, does cause vasoconstriction and reduced blood flow to an area of the body, but when you remove the ice, there's almost a rebound effect of a big flow of blood to the area, and that can cause an increased risk of developing lymphedema. So how do we reduce risk for lymphedema? So this is

where I really do my best to educate my patients about limiting their risk or minimizing their risk for developing lymphedema. So really we try and minimize opportunities for infection and inflammation. So skin care is a big part of that. Moisturizing, avoiding cuts, scraps, burns, and caring for properly. I tell my patients that you can't expect a paper cut, something as minor as a paper cut or a shaving nick or cut to heal the same way that it normally would. Remember, the lymphatic system is part of our immune system so it may not heal the same way that it normally would. So making sure that you're keeping that area clean and covered until you're fully healed, particularly in areas of decreased sensation or skin folds. So remember, radiation can cause decreased sensation. Surgery itself may cause decreased sensation in the axilla. Skin folds may be there already because of lymphedema or just because of body habitus. But obviously, those are areas that are at increased risk of injury and infection. So patients have to be careful shaving, or sometimes we advise that they use an electric razor to shave underarms to minimize risk. Caution with nail care.

So knowing your nail spot and sort of making sure that they are keeping things clean. We typically advise our patients to avoid extreme temperatures. So saunas, hot tubs, heat and ice modalities that I already talked about. I would take this with a little bit of an asterisk, little bit of a grain of salt. I think that there is sometimes, oftentimes, room for discussion with the patient's referring practitioner. If I have a patient tell me, nothing makes me happier than getting in the hot tub with my husband or with my wife at the end of a day, who am I to say, no, never again can you go in a hot tub? That may facilitate a conversation with their referring practitioner to then say, what do you feel like the risk is? And if they say, okay, give it a shot, what I recommend is, well, don't get in the hot tub for an hour or two hours your first go. Maybe get in for 10 minutes and be particularly aware of your limb or of the region of your body that may be at increased risk for developing swelling. And understand if you do develop swelling, then that's, need to follow up and get treatment for. Furthermore, we advise our patients to avoid tourniquet effects of tight clothing and accessories, thinking about the arms and the

hands. This typically comes into play in terms of bracelets and rings and watches. Weight control and diet is a big part of this. I mentioned obesity can lead to increased risk, so working to control weight. Hydration can be a big part as well. So it can be sort of intuitive for a patient to say, oh, I've got this fluid weight, so in order to reduce my fluid, I shouldn't drink as much. But sort of on the contrary, low blood pressure and dehydration can actually result in fluid retention, so helping to educate patients about that, as well as excessive alcohol consumption resulting in dehydration and inflammation. And staying active. So careful progression of exercise, obviously, with monitoring of symptoms.

So there is a big role for exercise training here. The traditional approach was to limit lifetime lifting to five to 15 pounds. We basically said, oh, that limb is at risk for lymphedema. Don't use it or else you'll get lymphedema. But to put this in context, a gallon of milk, it weighs eight pounds. So this precaution actually could lead to deconditioning of an affected limb, and then limb deconditioning could result in ADLs requiring near-maximal work of the affected arm, potentially leading to injury or muscle overuse and an inflammatory response that may actually overwhelm the damaged lymphatics. So this traditional approach of don't use the arm, we actually now know increases the risk of developing lymphedema and increases the risk of injury.

So evidence, on the flip side, indicates that upper body exercise is safe for survivors with and at risk for developing lymphedema. There's some evidence that quality of life is improved by weight training in breast cancer survivors. And the recommendations that are generally made about a weight training program for patients with or at risk for developing lymphedema is that it should be controlled, so gradually progressed. So not just jumping into what you used to do at the gym or else you may experience muscle overuse and swelling and soreness, but really just sort of starting low and then gradually working up, and then with gradually fading supervision. So initially intensive with eventual transition to independence, which is usually our approach with PT

anyway. So PT intervention for lymphedema, just so you have a sense of what it entails, is termed complete decongestive therapy, or CDT. A lot of components go into CDT, first of which is manual lymph drainage, or MLD. The concept of MLD is a specific manual technique to move lymphedema, move swelling from an area of disadvantaged lymphatic system to an area of the lymphatic system that is more equipped to reabsorb that lymph swelling. So if we take an example of a woman with left upper extremity swelling, it may be massage techniques to manually move that lymphedema across the chest to the right axillary lymph nodes, if they are intact, or perhaps even down the lateral chest wall down to the left groin and the left pelvic lymph nodes where that lymph fluid can then be reabsorbed. Manual therapy for soft tissue restrictions can play a role here. This is one way that I, as a normal gym therapist, feel like I can play a role in lymphedema. Opening things up and loosening things up can allow lymph fluid to flow better, which then can make manual lymph drainage even more effective. Bandaging is sort of the gold standard for lymphedema therapy.

It's a graduated compressive bandaging that starts distal and works up proximal to push fluid out of the limb or out of an area. Once swelling is stable and optimized, compression garments can be utilized, which is a form of compression, obviously, that is more easily donned and doffed and does make managing a little bit more easy to manage for these patients. Exercise, I mentioned, is an important part. There's actually a role for diaphragmatic breathing. So this is another way that I, as a gym therapist, feel like I can play a role. The diaphragm, because of the way the lymphatic system pierces the diaphragm in the same way as the esophagus and the aorta, performing diaphragmatic breathing can actually stimulate the lymphatic system and create sort of a negative pressure on the system, which most of our Certified Lymphedema Therapists actually begin their sessions with diaphragmatic breathing. So no reason why we can't incorporate that into our own sessions. Skin care is an important part, both through education and through our coaching. And as I just mentioned, patient education and self care and risk reduction is key. This is a chronic condition. This is a

lifelong condition, unfortunately, for these survivors, and so it's really important that we educate them on how to minimize their risk for the rest of their lives. So some summary here. So the risk for developing lymphedema is a lifelong consideration, just to beat that dead horse. We are in a position to monitor and educate our clients. Oftentimes, we see these patients more frequently than even their oncologist. So we can monitor and help our patients monitor themselves. This is an opportunity to confidently refer. This lymphedema does require an interdisciplinary team approach. So if you see any of those signs or symptoms that I mentioned accompany or are characteristic of lymphedema, referring back to the referring practitioner or asking for a lymphedema order, if you offer those services at your clinic, getting that patient with the services that they need.

So just wanted to point this out. So this is a lymphedema fact sheet. This is available via the Academy of Oncologic PT's website. So if you go to oncologypt.org, you can find this lymphedema fact sheet as well as some other fact sheets and some really good resources, but this is really nice. You can offer this to patients. Lymphedema, how can physical therapy help? So what is lymphedema? How do I know if my swelling is lymphedema? What are the risk factors for lymphedema? It's a good reminder for you, if you're gonna be seeing these patients, but also it can be good information to offer patients.

So just to work through a quick case study here, as I work to beat the clock. We've got a 34-year-old female status post right-sided lumpectomy and adjuvant radiation therapy referred to PT for right upper extremity weakness. The patient's chief complaint is that her right upper extremity feels heavy and achy with difficulty performing her normal work duties as a manager at a local restaurant. Okay, so first of all, looking at the case, sort of trying to stratify her risk level. So she did have a lumpectomy, as opposed to a mastectomy, so that, I think, would carry a lesser risk. But she did have adjuvant radiation therapy, which does increase the risk. So take that for what it's

worth, just understanding what she's been through. I wanna know exactly when her symptoms began. So is this something that, well, certainly, was this present pre-surgically? Is this something that occurred just following surgery? So we may be able to attribute it just to the surgery. Or is this coming on following the radiation therapy? When did she start to notice these symptoms? And are the symptoms fluctuating? Typically, lymphedema comes and goes and fluctuates. Does she feel like it's getting gradually better? In which case, maybe this is more attributable to post-surgical or swelling associated to the radiation therapy, or are things getting gradually worse, which may force us to triage things a little bit differently. What are her other subjective symptoms? Has she noticed rings or clothing feeling tight? Again, just sort of building a case for, is this lymphedema? I wanna know what work duties are most difficult.

So is this something that she experiences just after carrying a huge, heavy crate and then the heaviness and the achiness comes on and gradually reduces? Or is this something that she feels all the time? Is it something she feels as she's trying to reach up to a high shelf? When is she getting these symptoms? In terms of observations, I wanna look at the skin quality. Is there any of that orange peel appearance? Is there pitting edema? Does the limb look swollen? You might be able to tell just by looking at it. As far as my evaluation goes, I'm gonna look at range of motion, active and passive. Trying to figure out what exactly is causing the symptoms here. I may take some quick circumferential measurements.

So, again, I'm not a lymphedema therapist, but what I typically do is take three measurements. I take them at standardized points so that I can reproduce. I typically take a measurement, and I do this bilaterally, at the axilla, so the superiormost aspect of the arm, at the medial epicondyle of the elbow, and then at the radial or ulnar styloid process, so down by the wrist. Typically, if there's a difference in between the limbs, anything under than two centimeters is typically considered a subclinical difference,

but they may be in that latent stage. May be still a good reason to refer. Anything over two centimeters is a little bit more concerning for the presence of lymphedema. So most likely, I am going to refer back to the referring practitioner for a lymphedema order and evaluation. Question is, do we keep her on program? Well, does she have PT needs? So she's referring to this arm as heavy, as this achiness. Does she have soft tissue restrictions related to her surgery? Does she have weakness related to her treatment? Is getting her stronger gonna help her manage this potentially lymphedemous limb? My thought would probably be yes. And regardless, whether we're gonna have her come back or not, really doing our best to educate that patient on day one before she walks back out the door so that between now and when she sees that lymphedema therapist, she can minimize her risk and optimize her risk, or optimize her chances for managing this condition. Okay, so I've snuck in just under the wire here. I think we do have maybe a minute or maybe two minutes, a couple minutes for questions if anybody wants to ask any questions.

So I do see a question here. Somebody asked, "Is lymphedema and bloating the same?" Tricky question, and I think it can be tricky to differentiate between lymphedema and different kinds of swelling, whether it's lymphedema or postoperative swelling or lymphedema and swelling related to radiation. When does that window of postoperative swelling and radiation-related swelling end and sort of the window for lymphedema begin? That's a tough question. I don't know if there's a great answer, or at least that I have a great answer. Might the patient just be experiencing bloating? It's possible. So I think looking at the other risk factors. What has their treatment been? Working to stratify their risk a little bit, and in the end, erring on the side of safety and referring back to the referring practitioner if need be. I see another question here. "Are general massage techniques allowed "with lymphedema massage techniques?" So there is some differentiation, I think. It's not uncommon for me to be seeing a patient for PT, for sort of gym-based needs, and that patient seeing a Certified Lymphedema Therapist at the same time, in which case, we do kinda have to differentiate what our

treatments are. So the lymphedema therapist will really focus on manual lymphatic drainage, sort of that more superficial massage intended to move the lymph fluid, whereas the general massage techniques, the soft tissue massage or the myofascial release, the scar tissue mobilization, that's gonna be more in my arena and where I feel like I can play my best role.

- [Calista] All right, we do have a few more questions. Dr. Wechsler, I do see a question here. "Are there any precautions we should take note of "for patients with mastectomy "in terms of being around diathermy?"

- [Stephen] Good question. I'm not so familiar with diathermy in my own practice. But I would think, in a similar way as to a heating modality, if we know that diathermy is going to increase blood flow, at least I'm sort of digging deep back into my toolbox for this one. If diathermy is going to increase regional blood flow to an area, then yes, I would think that we need to take precaution in an area that we know is at increased for developing lymphedema.

- [Calista] And we have somebody wanting to go over question number 10. And that question reads, "Lymphedema risk reduction techniques that all patients "who are at risk for lymphedema should be educated on "include all of the following except "skin care, exercise, weight control, "and then avoid lifting greater than 15 pounds."

- [Stephen] Yeah, so I'm happy to cover that one again. We talked about the importance of skin care in terms of moisturizing, reducing risk for cracking skin, and treating cuts and burns appropriately. We talked about the importance of exercise, gradually progressed exercise, to optimize the ability to perform ADLs and to perform lifting tasks. We talked about weight control, how obesity can be a significant risk factor for actually increasing the risk for developing lymphedema. The one thing that we have sort of debunked in the research is that old traditional mindset of avoiding

lifting anything greater than 15 pounds. The answer is no longer that you can't avoid lifting, or, I'm sorry, that was a double negative. The current mindset is no longer that we have to avoid lifting over 15 pounds, but more than a gradual and progressive resistive exercise training program is actually more beneficial. So I hope I haven't given you too much of a runaround on that one, but the avoid lifting is sort of the debunked risk reduction technique. I see another question here. "Do you take into account the cardiotoxic chemo side effect "when you are recommending exercise?" Yes. I think that is also really important, Holly. It's really important, it was a little bit beyond the scope of today's lecture, but certainly something that can impact function in survivorship. I think cardiopulmonary toxicity is oftentimes underscreened and underdiagnosed. So in some cases, I think that we, as the evaluating physical therapist, can sometimes pick up on those things. I'm anxious to see, ACSM has updated guidelines for exercise for cancer survivors coming out in hopefully just a couple months, I think, or maybe just October, it's coming out, next month. So I think that there's gonna be some consideration of cardiopulmonary toxicity in those updated guidelines. I'm excited to see kind of what the new consensus is.

- [Calista] And then there's a couple questions on skin care. "Following up on skin care, "are there certain creams or lotions "that may have harmful effects "when combined with certain chemo or cancer treatments? "And do you have any recommendations "for patients on those "lotions or creams?"

- [Stephen] I think the quick answer is yes. There are certain creams and lotions that may interact in the wrong way with certain chemotherapies or cancer treatments or even radiation therapy. So when it comes to, when it comes to recommending lotions, the farthest I go is to say usually something mild or something very gentle is safe, but I would check with your oncologist or I would check with your radiation oncologist to make sure that there's no concern for interaction with your cancer treatment. So I usually kind of deflect or defer that, as it's not my area of expertise. At Memorial Sloan

Kettering, at least oftentimes, the radiation oncologist will have certain products that they'll recommend for skin care. So I usually defer to the referring practitioner.

- [Calista] All right, and I think we have a couple questions regarding the quiz, and I believe, then, we'll wrap it up. "Which of the following is considered "a negative symptom associated with "chemotherapy-induced peripheral neuropathy?" If you can review that one. "Tingling, burning, pain, and numbness." And it's which of the following is considered a negative symptom?

- [Stephen] Right. So this one is a little bit tricky, and I don't blame anybody for being a little bit confused about this. So negative symptom, all of these are bad symptoms, really. We can say that. But the negative symptom in regards to CIPN is in reference to sensations that are removed. So in this case, it would be numbness, as opposed to a positive symptom, not meaning a good symptom, but a positive symptom meaning a sensation that is added, which in this case would be tingling, burning, or pain or itchiness.

- [Calista] All right, and the last one is related to number four. "Which of the following outcome measures "was recommended by the Oncology Sections Task Force? "Hand grip dynamometry, numeric pain rating, "the DASH, and then a visual observation?"

- [Stephen] So, these four options, the hand grip dynamometry, numeric pain rating scale, the DASH, and visual observation are all common parts of my evaluation, depending on how the patient presents, depending on what their chief complaint is. The DASH, the Disabilities of Arm, Shoulder, and Hand, is the only one out of that list that was recommended by the Oncology Section Task Force to utilize in breast cancer survivors to measure upper extremity function. So that answer would be the DASH, though all of those answers are good objective measures to utilize.

- [Calista] Wonderful. That was our last question. So thank you so much, Dr. Wechsler, for another great course. And like I said before, if anybody did miss the other one, it is available on recording, so definitely check that out. Is there anything else you wanna leave us with before I officially close out the course?

- [Stephen] No, that's it. I appreciate everybody's time and questions, and I hope that today was helpful.

- [Calista] Wonderful, all right. I'm gonna officially close out today's course. Have a great day, everyone.