CHRISTINA W CHENG: Good morning, everyone. I want to thank Dr Furey and his team for putting this program together, and also inviting me to give this talk. So today, I'll be talking about metastatic disease. And this is a topic that can be hours long. But I'm just going to try to condense it in 15 minutes. So it'll be pretty broad.

So I have nothing to disclose. So as we know with increased advancement in cancer treatment, patients with advanced cancer stages are living longer and developing metastases. And bony metastases is actually the most common skeletal tumor that we see as orthopedic surgeons. And the spine is the most common sight for skeletal metastases to occur.

And about 70% of patients with terminal cancer have spinal metastases on post-mortem exams, and about 18,000 new cases of spinal metastases are diagnosed each year. In fact, in some cases, spinal metastases is actually the initial presentation of malignancy in about 20% of patients. And these are usually the most difficult conversations you can have with the patients.

So the main primary tumor that metastasize to the spine or thyroid, lung cancer, renal cancer, prostate cancer, and thyroid cancer. We also commonly see melanoma, myeloma, and lymphoma. The most common site along the spine where they would like to land is the thoracic spine followed by the lumber and the cervical spine.

And how these cancers spread from their primary site to the spine is usually by hematogenous spread through segmented arteries or the Batson venous plexus, which is a network of veins connecting the pelvic veins, thoracic veins to the spine. And like Gabe had mentioned earlier, similar to infections, you can have these lesions all along the spine and can be skipped along the spine. So it's very important to evaluate the entire spine. So about 10% or 40% of these patients have an involvement of multiple areas.

And these lesions can have different presentation. They can be lytic, where it looks like the bone is getting eaten at. Or blastic, where it looks like there's a lot of bone forming. Or a mix of both. So prostate cancer usually has a more blastic, while breast cancer is more of a mix, and lung cancer is more of a lytic picture.

In terms of clinical presentation, the majority of patients come in complaining of back pain. And they may or may not have neurologic symptoms. So they may have radicular pain or a myelopathy or [INAUDIBLE], depending on the location of the tumor. And some may show up paraplegic or quadriplegic. And then there's some instances where these patients are just asymptomatic, and they just found the lesion while doing the imaging for something else.

So when you see these patients, we have to make sure we get a comprehensive history. Look for any red flags that would point at malignancy, such as history of malignancy or any constitutional symptoms. And also get a good physical exam, evaluate for any neurologic deficits.

You can also observe their posture. If there is any concern for malignancy causing any fractures, they may start to fall into kyphosis or have difficulty walking. And also tenderness to palpation. Sometimes these are pretty painful for these patients.

So where do you go from there if you have a high suspicion for malignancy? Obviously, radiographic evaluations are helpful. Plain films, bone scans, CTs, and MRIs. And you know, x-rays is the first thing you want to get. This is the easiest and easiest access to.

So with x-rays, you know, I would normally like to get a bright imaging. It allows you to assess for alignment and stability. There are certain signs that you can look for that may suggest something's going on.

So one is the winking owl sign, which is a sign of pedicle destruction. So if you look here, here is our normal pedicles, where you have a nice white ring around. And then this would be an example of a pedicle that's destroyed just from some kind of pathology that's going on.

Another thing that you can look for is a paraspinal shadow, which can suggest some lesions within the paraspinal regions of the spine. And then in worst case scenarios, you can see a pathologic fracture, such as vertebral collapse or fracture dislocation of the spine. However, X-rays are not the perfect way to evaluate because you need about 30% to 40% of trabecular bone loss in order for you to actually see something on X-ray. So just because you don't see these findings doesn't mean the patient

doesn't have a metastatic disease.

A bone scan is also an option. So bone scans are mainly used to detect metabolic bone turnover. And in some cases, it can also show earlier signs of metastases earlier than you would see on plain films. However, these are not very specific because you can get positive signals in patients who have infection or degenerative changes or fractures that are not related to malignancy. So it's kind of hard to differentiate.

And then there's some cancers, such as multiple myeloma, which may not even show up on a bone scan. So the best imaging, I think, is MRI with and without contrast. It allows you to evaluate the soft tissue, the nerves, the spinal cord. It allows you to evaluate away for cord compression and signal changes.

It's also helpful in differentiating acute compression fracture secondary to osteoporotic patients versus a metastatic disease. It also allows you to look at adjacent levels. So similar to what Gabe has said earlier, we will want to get the full MRI of the spine just to make sure there's no other lesions along the spine.

One thing that's also helpful is the use of MRI in differentiating between tumor and infection, which I think is very helpful. So because of that avascular nature of the disc in tumors, usually the disc space is spared. But in an infection, the bacteria are able to release enzymes that can degrade the disc, and you will see involvement of the disc with infection.

And then CT is also another helpful imaging which let you evaluate the bony anatomy as well as the extent of bone destruction. I think it's helpful determining if a mass is a bony mass versus a soft tissue mass. And also it would help the surgeons in terms of preoperative planning. It allows us to evaluate the foundation and how we can put our instrumentation if surgery is indicated.

However, unlike MRI, you can't really evaluate the soft tissue involvement as well. And then in patients who can't tolerate MRI, CT myelogram is an option. Basically, you inject dye along the spinal canal, which then you can see any displacement in the dural sac or nerve root, which you can see with any mass effect.

So similar to infection, when you have a patient with metastatic spine disease, it

involves a multidisciplinary team approach in order to care for the patient. So it involves a group of physicians from different specialties just to help with, not just the physical, but also the emotional aspect of the disease.

We also depend on our physical and occupational therapists to help them get stronger nutrition, to help improve healing. A social worker to help just get them settled. And nursing, of course, just to help with everything else within the hospital, either before or after surgery.

So actually, at UH, we have a protocol that we use for patients who are found to have cord compression. And I know this is pretty busy, but you can get a copy of this on the UH internet if you were interested in looking at it. So basically, a physician will order imaging of a person that they think has cord compression or metastatic disease.

And once it gets reviewed by the radiologist, they would see the cord compression, and what they would do is try to contact the physician who ordered the MRI. And then they would determine if the patient needs to come to emergency or not. However, if the physician can't be reached, then the transfer center will call a three-way call between the radiologist, the spine surgeon on call, as well as the ED attending, and determine if the patient needs to come in.

And then once the patient is in the hospital, they get evaluated by the spine surgery team. And then between the spine surgeon, the medical oncologist, radiooncologist, we then discuss what's the best management for the patient. So once you have a patient who you know has metastatic spine disease or a lesion in their spine, you have to try to determine what is this.

Is this a metastatic lesion or is it a primary neoplasm or is it infection? Especially in people who don't have a history of malignancy. Sometimes chest, abdomen, and pelvis of CT is good to look for a primary source. However, I think the CT guide biopsy is probably the most helpful and can tell you the most information.

Similar to infection, you'll want to biopsy the most assessable lesion which would cause the least morbidity. And then you also want to send these samples for both pathology and infection because, you know, you never know what it is. I had a patient in fellowship who we thought was having malignant cancer. And when we

got the biopsy and culture back, it turned out to be tuberculosis. So I guess that's better than having a malignancy. And then once you know what it is, that will guide your management.

And so laboratory studies may also be helpful if there is any suspicion of a specific type of metastasis that you're looking for or have suspicion for. So management of these patients is mainly palliative. Our goal is to help them with their pain relief, improve any neurologic deficits or function, stabilize the spine, and try to improve their quality of life.

And with this approach, it can be non-operative versus operative methods. So there is different classification, different scoring systems that's been developed to help guide us in terms of how should we manage these patients. And we're not going to go into details. I think you should have been in your booklet, I think.

One is the Harrington classification, which is based on neurologic status, as well as bone stability. There's also the Tokuhashi system, which can help evaluate prognosis and life expectancy. And then from there, determine what kind of management. And then there's also Tomita system. That's based on the primary tumor growth, visceral metastasis, or bone metastasis.

However, you know, these are all just for guidance. You shouldn't base your treatment based on these classifications and scoring systems because each patient is different. Different comorbidities and each cancer is different and they respond differently. So that's why you need a multidisciplinary team, because everyone is specialized in every different aspect. And together, when we work together, I think that would provide the best care for the patients.

In terms of non-surgical management, usually these are reserved for patients who are asymptomatic, a structurally stable spine, no neurologic deficits. Or patients who are just too high of a surgical risk for surgery. People with multiple comorbidities or people with life expectancies that are less than three months.

For these people, you can start with a steroid, which can help. People who may have mild neurologic symptoms, such as radiculopathy or something, you can start with steroids to help with the decreased swelling of around the spinal cord and the nerves. However, the optimal dose for steroids is pretty controversial.

Bisphosphonates has also been shown to be helpful where they can slow down the bone resorption and help with pain control in people with breast, prostate cancer or multiple myeloma. And then depending on the tumor itself, your patient may be a candidate for chemotherapy or radiation. In terms of radiation, this is just a chart of the different types of cancers and their sensitivities to radiation.

In terms of surgical treatment, these are reserved for people who have neurologic deficits who have radio-resistant tumors or intractable pain despite radiation, or people with spinal instability, which can potentially cause neurocompromise. With surgery, our goal is to decompress the neural elements, take the pressure off, reconstruct the spine to stabilize the spine. And then depending on the cancer, they may be or may not be eligible for post-operative radiation.

So this is a study by Patchell, et al, who compared patients who had surgery and radiotherapy versus radiotherapy alone. And this was a randomized study with the primary endpoint to see a patient's ability to walk after treatment, as well as other secondary endpoints. And the trial actually stopped early because patients who had surgery with radiation therapy actually did a lot better than patients who had radiation therapy alone.

So about 84% of those who underwent surgery were able to walk post-operative versus 57% who had radiation alone. And those who were unable to walk before surgery, 62% of those regained the ability to walk. And then about 20% of the patients who were in the radiation group actually crossed over to the surgery group because they were having a decline in their motor strength.

However, these are their inclusion criteria and exclusion criteria, which were pretty specific. And not every patient fits into these criteria. So again, you have to take this as a guidance. If a patient actually falls into this criteria, they may have the same response. However, there are patients that don't. So again, that's why we need to depend on each other for assistance in managing these patients.

And another procedure that I just want to mention is kyphoplasty. So kyphoplasty plastic is the use of cement to help fill up a collapsed vertebral body. This is used in patients with osteoporotic fractures, as well just to help with pain.

However, only certain people are candidates for these. You have to have an intact posterior wall along the vertebrae to prevent any cement leakage into the spinal canal. Obviously, that would be a pretty big complication.

So in summary, with improved cancer treatments, there are increased survival of patients with these advanced cancer, with increases to incidence of metastatic disease. So again, this is a multidisciplinary team approach in managing these patients in order to formulate an individualized management plan. And biopsy are pretty helpful in identifying the lesion.

And management for these patients are mainly palliative. So our goal is to prevent neurologic compromise, reduce pain, stabilize the spine, and try to improve their quality of care. Thank you.