Melanie Cole (Host): Welcome to the podcast series from the Specialists at Penn Medicine. I'm Melanie Cole, and joining me today is Dr. James Metz. He's the Chair of Radiation Oncology and the Henry K. Pancoast Professor of Radiation Oncology at Penn Medicine. He's here to highlight for us the recent milestones in the Radiation Oncology Department at Penn Medicine.

Dr. Metz, it's a pleasure to have you join us today. Can you start by briefly explaining the difference between proton therapy and photon therapy? Penn Radiation Oncology is deeply involved in advances in both types of delivery. So begin though with proton, which has come quite a long way since the Robert Proton Therapy Center opened 13 years ago.

James Metz, MD: Yeah. Thanks so much for having me, Melanie. So the difference between protons and photons. Photons are conventional radiation. It's what we've been delivered for many decades, and it's a powerful x-ray, a higher energy x-ray. What we do with photons is we come from different directions to concentrate the radiation dose at the tumor itself, but x-rays go in one side of the body and out the other side of the body.

That's why we can see a regular x-ray on someone. Protons are different. Protons actually enter the body at a lower dose, release all their energy at a point. And stop. So there's absolutely no radiation beyond the target and much less in front of the target compared to standard x-rays. And that gives us the opportunity to reduce exposure of radiation to normal tissues.

And when we reduce exposure of radiation to normal tissues, you reduce side effects, and that could be wherever the body we're treating. So that's the critical difference between the two of those. And it's really a physics difference. The biology's the same, so biologically, photons, and protons act the same way. We've actually treated over 8,000 patients with protons, at this point. Over 250,000 fractions specifically, have been delivered with protons so far at Penn Medicine.

Host: Well, you just got to my next question. So how does that 250,000 proton fractions demonstrate your experience and expertise with proton therapy? Really leading the world in educating and training other physicians in proton.

James Metz, MD: Yeah, the Roberts Proton Therapy Center has really become the world leader in proton therapy in a number of ways. Over the last 13 years, we've developed novel ways to treat new diseases, different diseases. We've expanded the use of proton therapy in many different disease sites, and we've developed the technology that's been led the way for the last decade or so.

So because of that, we've become the leading training institution in the world for proton therapy. We train more people than anyone else across the world in a variety of aspects, whether that's physics, therapists, dosimetrists that do the planning, or physicians come here to Penn Medicine for training or work on our, our website for additional training.

And we also license our content through two of the major vendors, Varian and IBA. So when they sell proton systems, actually Penn Medicine is licensing that training through those systems. So that's why most patients are coming through Penn Medicine actually for this incredible experience.

Host: That's amazing, Dr. Metz, and we understand you've opened two new proton centers. Tell us how that's expanding access to proton for patients across the region, bringing your years of experience to new sites, and why is it important to bring proton out of the city?

James Metz, MD: This new expansion is really important to us. It's the first, what I call hub and spoke model of proton therapy, where our hub is our main site downtown, the Roberts Proton Therapy Center, and now we've integrated single room centers into large conventional practices. So it's not proton therapy by itself. It's integrated with conventional radiation at Lancaster and in Virtua in South Jersey. All the patients get their simulation or planning locally, so they'll get their CT simulation or other simulation, whether it's a PET scan or an MRI scan. The information is then shipped downtown, where our planners who've been doing this for the last 13 years, do the planning and plan out the radiation doses, because it turns out, that actually takes a long time to develop that skillset.

And we want to open these facilities at the highest level. So that information is shipped back to the local site, and then radiation therapy's delivered based on our protocols that we've developed downtown. So it allows these centers to open at the absolute highest level with oversight from downtown, with centralizing certain key resources like planning and also quality assurance and physics. QA is really critical, and that's also centralized. But we now deliver this therapy closer to patient's home because many of these patients are coming for 5, 6, 7 weeks for treatment. It's not easy when you're traveling a distance and getting treated for cancer. So we can actually make it a lot better from a quality of life perspective, for these patients getting therapy closer to home at the highest level.

And we've obviously selected where we've placed these centers and we've put key expertise in these areas to deliver very effective proton therapy.

Host: Dr. Metz, let's discuss the latest innovations in intensity modulated radiation therapy. Please tell us how Penn delivered the world's first radiation treatment on a Halcyon system equipped with Hyper-Site. Tell us a little bit about this and what makes it so exciting.

James Metz, MD: So even though we're doing proton therapy, intensity modulated radiation is incredibly important. In fact, most of our patients are treated with that. We developed what's called the Halcyon system with Varian a few years ago and treated the first patients in the world here at Penn. What that is, it's a linear accelerator that's simplified, it's simplified in the number of energies it has.

It's simplified. It doesn't require as much shielding. It's simplified that it doesn't require as much power, and it's simplified that the therapists that run the machine have much less steps to do to deliver the treatment. This actually turns into a much more rapid treatment for patients. So a typical IMRT treatment may take 27 to 30 minutes on a typical linear accelerator where it takes less than 10 minutes on this machine. And from a standpoint of what the patient feels and sees, it's just much easier to lay on a machine for less than 10 minutes than up to 30 minutes on a machine. As you can imagine, particularly when they're under masks or other immobilization devices that aren't necessarily the most comfortable things.

So it's a much more rapid delivery. We've recently developed what's called the Hyper-Site Linear Accelerator, which is a next generation linear accelerator with Varian and treated the first patients in the world at Penn Medicine in February of this year. What this does, in essence, combines a CT with a linear accelerator.

So the imaging quality goes up to the same as a CT. So it really gives you a big broad field of view. It allows us to better see internal organs with the linear accelerator itself, and that opens up opportunities to actually see some targets that are more hard to define with what we call cone beam CT that's on a usual linear accelerator. This is a next generation CT scanner.

It also allows us to potentially move to something called Sim and treat. So right now, when a patient gets planning for radiation, they have to come in, get a separate simulation, then get transferred to a linear accelerator after planning and treated. This allows to potentially down the road, do this all on one machine, which really makes it more efficient for patients coming in for treatment. So we're very excited about this new technology that we just launched at Penn.

Host: Incredible medical advancements. Dr. Metz, and we hear a lot about flash proton therapy. What exactly is flash therapy and what are its possible indications? Is it being studied at the Roberts Proton Therapy Center?

James Metz, MD: Flash radiation is really an amazing technology and what it is, it's ultra high dose radiation. When I say ultra high dose, I mean more than 40 gray delivered in less than a second.

Well, what's that equate to? It equates to typically an entire treatment course is given over 5, 6, 7 weeks. If we can deliver that entire course of radiation in less than one second, we can see the same tumor control with less side effects, and that can be completely disruptive to cancer care down the road if this works out.

We've been started this a number of years ago, about four, five years ago at Penn Medicine. First in cells, then in small mice, then we moved into dogs. We're actually working with the vet school to treat people's dogs that have developed cancer to help them. And we've got a number of clinical trials moving in dogs, and we plan to move in human clinical trials in the next year.

So it's really on a rocket ship and how fast this is coming. But we're incredibly excited about this and we're looking at a number of disease sites now. We're working with the Food and Drug Administration to determine what they're going to allow us to move forward with first. But, as you can imagine, this is an exciting therapy that we're looking at, a lot of difficult to treat tumors, from head, neck, thoracic tumors, abdominal tumors.

We eventually think this may be important for pediatrics, although we won't start with that on day one, as there is a lot of quality assurance things we have to ensure; when you can imagine we're delivering a radiation dose in less than a second, everything has to be perfect. So we're working closely with the company and the FDA to optimize this, but I expect within the next year to start human clinical trials.

Host: Such an exciting time in your field, Dr. Metz and I can hear that passion for what you're doing in your voice, and it's such a comprehensive approach and such advanced medicine. As we wrap up, I'd like you to tell other providers what you'd like the key takeaways from this episode to be, the multidisciplinary and collaborative approach that you use at Penn Medicine, and anything else exciting on the horizon you'd like other providers to know about.

James Metz, MD: Penn medicine is really continuing to push innovation for the future, whether that's in conventional radiation with IMRT or Proton

therapy, and we'll continue to drive what's best for the patient. But what we really want is every tool in the radiation oncologist toolbox, so you as providers can send those patients to be evaluated and be assured, we will choose what is the right therapy for that individual patient and what technology fits them best, whether that's proton therapy or advanced IMRT. We have all those therapies available here at Penn Medicine to help patients, and we're going to continue to push the future with flash radiation and other technologies that we're excited about.

Melanie Cole (Host): Thank you so much Dr. Metz for joining us today and such exciting advancements in medicine. I hope you'll join us again and give us updates anytime. To refer your patient to Dr. Metz at Penn Medicine, please call our 24/7 provider only line at 877-937-PENN, or you can submit your referral via our secure online referral form by visiting our website at pennmedicine.org/referyourpatient.

That concludes this episode from the Specialists at Penn Medicine. I'm Melanie Cole. Thanks so much for joining us today.