[MUSIC PLAYING]

ROBERT FRIEDLANDER: I'd like to provide an introduction to our special speaker, Dr. Dade Lunsford. Dr. Lunsford is a distinguished and endowed professor at the University of Pittsburgh. And within neurosurgery, there are not too many legends. Dr. Lunsford is a living legend of what he's done. He's really changed our field. He's one of my predecessors and the previous chairman of our department. And Dr. Lunsford has made many, many contributions to neurosurgery.

Probably the most impactful one is really the implementation and institution of gamma knife radiosurgery to North America. He brought the first gamma knife from Europe to North America and really implemented this as a tool to treat many, many patients in a very different approach than was traditionally done in a very minimally invasive using very focused radiation, which he will explain in greater detail.

Dr. Lunsford has won every single award that you can think of in the field of neurosurgery, and outside of neurosurgery, a great teacher and a mentor to many ways. So Dr. Lunsford, thank you for joining us today, and please, go ahead and take it over.

DADE LUNSFORD: So thanks very much for the very kind introduction. It's been an amazing ride in my long-term relationship to the University of Pittsburgh and then UPMC since-- having been here now for 42 years. I have the perspective of a long time here.

And one of the most amazing things about all of this has been the opportunity to be somewhat innovative in an environment which encourages innovation. But it's always been my belief that innovation without proof of value should not be considered a lasting innovation.

So what we have done over the 32 years that we've worked with the gamma knife in various forms is to try to demonstrate that what we do and why patients should consider this option is because it has been shown to have lasting value, both in terms of the response that we want and the target that we're treating, but also in the preservation of quality of life of patients.

We're going to give you a summary of experience related to a skull base tumor, which has been, for a hundred years, called an acoustic neuroma, but more fittingly called a vestibular schwannoma as this is a nerve sheath tumor that starts in most patients on the balance portion of the hearing nerve.

OK, so this is just a brief conflict of interest because of a relationship over the years that I've developed with industry, first with the manufacturer of the gamma knife, Elekta, and more recently serving on the Data Safety Monitoring Board of the focused ultrasound company, INSIGHTEC.

These are my colleagues and collaborators. There have been many over the years. Many of them are neurosurgeons, and many of them have represented Fellows who come to spend time with us and then joined our faculty, such as Dr. Niranjan and Dr. Kano.

We partnered with many collaborators as radiosurgery is really the epitome of multidisciplinary modern medicine. The colleagues include not just neurosurgeons but also radiation oncologists and medical physicists, the team of which is very successful in the overall care of patients with a variety of conditions, including skull base tumors, such as vestibular schwannomas.

So we'll start out with a case that I first saw many years ago. This was a movie executive working in Hollywood, actually a pretty powerful figure in many ways, and he develops some partial hearing loss, which waxes and wanes. He takes a cortisone packet, seems to get better.

But he has an MRI scan which shows this very little tiny tumor on the right side, which is a little area of white contrast enhancement at the base of the skull. And he searches for what is the best option for me to consider because he's known that the surgery can remove this tumor, but there's perhaps some risk involved in reaching and removing this tumor. There are many important structures nearby, including not only the balance portion of the hearing nerve but the hearing itself, nerves that work the muscles of the face, and it's tough to be a movie executive with a face that doesn't work quite right.

So he went to see a number of people over the course of time. And as [INAUDIBLE], he received a variety of conflicting opinions. Well, I can take it out no problem. If you do something else, you could watch it, see what happens for a period of time.

Or if you have this gamma knife thing, there are lots of risks involved in this. First of all, it may not work. Secondly, if it works for a little while, eventually, it'll grow, and I'll have to take it out, and it'll be stuck, and it'll be tough to remove. And finally, if all of this is not happening at the end, I'm concerned that radiation is going to cause you to get cancer, and you're going to have big troubles.

So then the question is, what to do? Since the development of gamma knife as a technique, one of the interesting things that's happened is many patients are told that they should just watch it for a period of time. You don't need to do anything. It's a benign tumor. It's slow growing, and we can get a scan periodically.

And some patients say, OK, we'll get a scan. And as you see here, over the course of time, the tumor grows. And we're going to talk a little bit about the impact of watchful waiting and the risk that that poses, especially for preservation of hearing. The average tumor doubling time of such a tumor is around 2.3 years.

So what are the goals of what we do here? First of all, the goal is to preserve function, to stop tumor growth, and to reduce the risks that happen with other alternative treatments, such as surgical removal. We don't see things like infections. We don't see things like spinal fluid leaks. And we wanted to determine over time could this prevent further growth while preserving nerve function.

So what is the technique? The technique as Dr. Friedlander said is to use focused radiation in the single treatment. This is an outpatient procedure, outpatient brain surgery. The patient comes in early in the morning on the day of the procedure. We put on a guiding device, which in medical terms is called a stereotactic frame. This provides tremendous precision. It allows us to make high-resolution, high-definition imaging of the tumor, which we do with MRI scan, and we supplement that with a CT scan.

After that, we make a plan using computer techniques to be able to bombard this tumor with crossfired radiation beams, anywhere up to 192 beams, so that the beam pathway reaching the target causes no biological change in the tissue through which it passes, but when it sums up on the target, which in this case is the tumor, the biological effect is profound in terms of causing damage to the cells of the tumor.

So what it leads to over time is regression of the tumor in the majority of patients, and the others, simply prevention of further growth. The real biological effect of the single session radiation is to prevent tumor cell division, but also there's a release of vasoactive factors, which lead to blood vessel narrowing, and there's a sort of starvation effect of the tumor at the same time.

So what happened to the ability to stop tumors from growing? And we've now looked at that over the course of the 32 years that we've done gamma knife. The short result is that over 90% of the patients, as you see on this graph, over the very long run have control of the growth of their tumor, so that in the end only about 1.5% of the entire series, which now is over 2000 patients, has any further growth of the tumor and needs to have anything else done.

There are a few patients in the follow-up interval, let's say, in six months to a year after the first scan-- and we do MRI and checkup as well as hearing tests when the patients have hearing-- the tumor may look like it's slightly bigger briefly and then stabilizes or actually begins to shrink over time.

So what about other nerves that are nearby, many of which cause significant morbidity for people, so for our movie producer with a weak face that will have a big trouble functioning in the starlit halls of Hollywood? So we wanted to make sure we could first save facial nerve function, and in fact, the risk of a facial nerve problem of any type at any time is now less than 1%.

The nerve that is above the tumor, as tumors grow, it can get pressed on. It's called the trigeminal nerve, and a few percentage of patients may develop some slight numbness sort of like very mild Novocaine effect if the dentist were going to block your teeth for teeth work.

And what we can see is that over the course of time if we take an entire series of patients with any level of hearing, we can preserve hearing in the group as a whole over the course of a decade or more in about 50% of the patients by the time you reach the end of the decade.

But what we wanted to find out was were there factors that would be important in helping to preserve hearing at a better level. So one we looked at was the volume of the tumor, and secondly, we looked at age. And as all of us know, it's better to be young than older.

And as a result, people less than 45 when first diagnosed are the ones most likely to preserve useful hearing in the course of time. But as we get older, that risk becomes somewhat greater, and similarly, as the tumor volume goes up, the risk is greater and hearing loss is greater. And finally, if the hearing is good to begin with, in this case called Gardner-Robertson Class I, the hearing is the best chance of long-term hearing preservation.

So we looked at this in more detail collaborating with one of our finishing residents who's now on the faculty in New Jersey. Could we use other measures to be able to look at predicting in advance which patients would have the best chance of hearing? And so we looked at age, and we looked at volume, and we looked at the high-level hearing to begin with among the factors that we could use to help predict hearing preservation.

And what together we did was we could look at age, the hearing-- Gardner-Robertson Grade I is useful normal hearing. Grade II is useful hearing. That is, you can listen to the telephone well, but maybe not get 100% of the words-- and the volume. And then we could look at the age, and we could develop a checklist in terms of where an individual patient is in this group.

Once the checklist was put together, we could then look at the hearing results over the course of time. So that if you were young, you had a smaller tumor, and you had excellent hearing or normal hearing called Grade I at the beginning, you could have a chance of preservation of your hearing in up to 85% of patients over the long run. And then, as these various factors were entered into it relative to the status of your hearing to begin with, your age, and other things, we can see that over time, we could predict much better what the chances of preservation of hearing were in these patients.

And this is really a summary of this with the overall opportunity to save hearing based on factors which at the very beginning, of course, we don't have any control of when we treat the patient. That is, we can't treat the patient if we know that the tumor has already reached-- we can treat them, but we can't predict the same good results.

And when the patient first shows up, the tumor is what it is at that time. Patient's age is what it is at that time. And the patient's hearing is what it is. But now we have a better way of predicting overall success rate in these patients, not just at one year, but even up to a decade later.

So these types of things also are looked at relative to when the patient was treated relative to their diagnosis because many patients are being told to just watch it, wait and scan in another six months or a year. And when we looked at that with one of our medical students here, we found that it was important that if we actually treated the patient within 2 and 1/2 years of the diagnosis. Then the hearing results were, in fact, significantly better.

More recently, Dr. Ogino in our group has looked at a series of patients who were watched over the course of time because they had excellent hearing when they were first diagnosed with their MRI showing a tumor, and they were told to just watch and wait, and let's see what happens.

So during the time of watching, which averaged about two years or so, we had a group of patients whose hearing was maintained, no change, and another group of patients whose hearing clearly got worse over the course of time. That's the hearing deterioration group. And what we found is that in the treatment of these patients, the patients who are much likely to have hearing preservation had early treatment compared to those who had later treatment.

Now, there are other techniques by which radiation can be delivered to tumors, such as this. And over the years, various alternative strategies usually done with the linear accelerators has been used to try to divide the dose into various treatment plans over the course of three days, five days, or even up to 30 days of treatment. So from a patient perspective, obviously, this is much less convenient.

And what we found actually is that this does not really add any benefit in terms of better hearing preservation and is really done because the technology that's being used is not able to deliver the dose safely in a single treatment because there's too much fall off of radiation outside of the target. So we don't find any value of this type of alternative option to what we do with the gamma knife.

We also looked at various types of findings in the imaging of the patient. One is a tumor that shows full contrast that turns white with dye, other ones that have small cystic changes, macrocystic, larger cystic changes and smaller cystic changes. And we looked at do they do differently because sometimes we were told that, well, you can't have your tumor treated because it's got bubbles or cysts in it.

And what we found out was that the tumors with cystic changes were, in fact, much more likely to actually slowly shrink over the course of time. This is a slow process. Just like growth took a period of time, shrinkage of the tumor takes a period of time as well.

Can it be repeated? Well, the need is relatively low, but let's say that 3% to 4% of patients who have sustained growth over time-- that is, after treatment scanned at six months or a year shows growth, or a scan at two years afterwards shows a little bit more growth-- can you repeat the gamma knife procedure?

Again, it's a minimally-invasive, outpatient, single-day procedure. So the answer is yes. What we did was look at this group of patients, and we found that of the people who were treated, all of those were safely treated. All of those patients had long-term tumor growth control, and no patient developed any new nerve problem as a side effect.

So we've actually done a multicenter study in a research foundation, which was formed here in Pittsburgh some years ago called The international Radiosurgery Research Foundation, and that confirmed that this can be done with a high likelihood of long-term tumor growth control over multiple centers that use the gamma knife.

So is it age dependent? Well, yes, it takes time for this to develop, but even bigger tumors-- we've just completed a study looking at larger tumors, tumors that are actually pushing against the brain stem and the cerebellum, and that's where these are located. And we find that these can be very safely treated with a 90% long-term tumor growth control rate and a less than 4% chance of any secondary weakness of how well the muscles of the face work.

So larger tumors can be treated, but if they have symptomatic mass effect-- what do I mean? If these patients come to us at first diagnosis with a larger tumor causing major imbalance, loss of equilibrium, falls at home, and headache, and if their MRI scan shows that this is causing pressure against the brain, then another option in some patients is to partially remove the tumor as seen on the middle side.

That takes the pressure off, and then, that allows us to do the gamma knife for the remaining much smaller tumor at a later time. And that improves the quality of life of these patients, reduces the risks, and allows preservation of cranial nerve function in a much higher or a much larger number of patients.

So one of the big worries over the course of time, as we mentioned in the first patient who was given this as a warning to begin with, can this very focused, single dose of radiation sharply delivered to a tumor lead to subsequent risk of either the changing of that tumor to a more serious growth form, a malignancy, or cause a tumor somewhere else to develop in the brain? And for the most part, at least in our experience, this is proven to be a theoretical risk.

We've treated over 16,400 patients with the gamma knife. And together, working with a group of other centers including NYU who published with us this report from Lancet Oncology, that the overall risk of developing such a problem with a tumor treated by the gamma knife was 0.045% of patients followed for up to two decades.

So overall and the summary of this is we have long-term tumor control rate in almost 2,000 patients. A retreatment is rarely but occasionally needed, and it's possible relatively few patients ever need to go on to other forms of surgical intervention. Facial nerve function can be preserved in the vast majority of patients, as well as facial sensation and hearing results are unequivocally better stratified by tumor size with the radiosurgery compared to surgical removal.

So this is a study done in the Medicare population which simply detailed in an era of microsurgery, which is how we do these tumors when we surgically remove them, there are still risks associated with this. And of course, this is the Medicare database, which means the patients had to be over the age of 65 or so. But we can see listed here are serious numbers of residual risks related to these tumors if we operate on them.

So what that means if you extrapolate those risks to the 100,000 patients who have had, across the world, gamma knife to treat their tumor, that there have been a large number of patients who've not died, whose facial nerves have worked, who have not developed blood clots or spinal fluid leaks or strokes related to the alternative of doing surgery. So we think that this has been a game changer in the management of many of these patients.

Certainly, tumors are being found at a much earlier time than ever before because of the widespread availability of MRI scan. In fact, if there's any patient who has ringing in one ear and has dizziness events, you should have an MRI scan just to prove that there's nothing there that would consider intervention. Don't wait, and if you find you have a vestibular schwannoma, in my view and the results of our center, don't wait. The results are much better and more effective with early intervention.

So these are the conclusions which I'll summarize at the bottom is treat when the patient is younger. Treat when the patient has the best hearing before it begins to deteriorate. Treat when the patient's tumor is smaller. That's really what our experience and what our data has shown in our almost 2,000 patients who have had gamma knife over these three decades.

So if you were a relatively young person, physician, graduate student, and you had some slight hearing loss, and you had a scan, and you saw this tumor, which you see here, and yet, you have pretty good hearing, it's a bigger tumor, not huge.

The patient has a mild imbalance, unfortunately tinnitus or ringing of the ear, something that's almost impossible for us to fix by any technique of surgical removal or gamma knife. But generally, most patients learn to suppress it when they're busy and active, and maybe they hear it only at night when they're going to bed and the house is quiet.

But in the end, this patient looked at all the options, and he made a decision to have gamma knife. So this is what happened over a time. He went on to get his doctorate. He went on to get an academic position. His face works fine. His hearing has been preserved, maybe slightly worse. He's got multiple research grants.

His tumor has regressed, and the quality of life has been maintained, and there was no significant impact of this tumor on this young man's life. And I think that he, as well as many other people faced with similar situations, need to hear correctly all the options, all the potential risks and benefits, and have the opportunity to consider radiosurgery as a effective and safe option for the management of their problem.

Thank you very much. That's a summary of what we've been working on, at least with this particular tumor over some three decades. If all the technologies are in alignment to work, I'm happy to answer any questions if they come up.

JUSTIN: Thank you, Dr. Lunsford. Such a fantastic presentation and also a career that you have. We're so grateful for those that you've trained and also the countless lives that you've saved. We're going to begin the Q&A portion of our presentation. We will try to answer as many questions as we can in our allotted time.

We do have a number of questions, Dr. Lunsford. First, what percentage of patients need radiation after a surgical resection of a vestibular schwannoma? Dr. Lunsford, you're muted.

DADE LUNSFORD: That's an interesting question, and that's changed over time because more and more patients do take the time to look at options. So the percentage of patients who have needed radiosurgery after a surgical resection is relatively low in their most recent years, but probably in the early years, let's say in the late '80s and early '90s, about 25% of the patients.

Now, in our view, just doing partial removal with no further treatment afterwards doesn't make a lot of sense unless you're pretty old or unless you have a lot of other medical risk factors. They'll say, well, we'll see what happens and things. Because this is a very low-risk, minimally invasive procedure, we typically wait after partial surgical removal for a period of several weeks, maybe several months. We want to wait at least until after surgery the facial nerve has completely gone back to normal before we do the gamma knife at that time. But for most patients with subtotal removal, if that's what they have, we would not just watch them because these tumors will continue to grow.

JUSTIN: OK, thank you. What do you think the future holds for the field of gamma knife surgery?

DADE LUNSFORD: Well, modern medical technologies have a shelf life of about seven years. That's sort of why administrators use that as the depreciation time. What happened with the gamma knife is that there's been a steady growth of the technology not only by technological improvements. We've put in six different variations of the gamma knife over these three decades. And there are continuing to be developed techniques that use focused radiation for treatment of these tumors or vascular malformations or certain pain problems or certain movement disorders for which we use gamma knife.

But to date, the only thing that looks somewhat interesting, I think, down the road, and that's why I wanted to list that in my conflict of interest, is that focused ultrasound has the opportunity to treat certain problems without using radiation but by heating the tumor in a guided [INAUDIBLE] approach for stereotactic technique. I think it's not going to in any way replace what we do with things like gamma knife. It's a different biological response of a tumor, but it is a promising technology to consider for especially a medical center of this size.

JUSTIN: Great, thank you. Given that such extensive research has already been done on gamma knife benefits for vestibular schwannomas, what further research needs to be done in the field, and/or has the entire field accepted gamma knife as the gold standard?

DADE LUNSFORD: Well, as we get trained in what we do, it's very important to keep an open mind, I think. And certainly, opinions have greatly changed over these years from the first years when there was great resistance and anxiety related to this.

It does change the training paradigm. It means that trainees in surgery radiation oncology need to learn about this technique because we look at our own case volume and how they were managed over the last 25 years at UPMC, the number of patients who are having surgery for removal is dramatically lower than the number of patients who elect to have gamma knife.

So we have to fix things like training bias where you learn one tool, and I know that, and that's what I'm going to do. Also, the tools have to be adapted for the patient. What may be suitable for a 25-year-old may be quite different for what would be appropriate for a 75-year-old patient.

I think that the importance of what is done is that just innovation-- as I started, innovation for innovation sake is really unacceptable. Innovation is extraordinarily important in modern medicine. But it's got to be the goal of the innovators to take the time and the effort to demonstrate that it has a value.

I don't think in terms of the gamma knife that there's going to be major new evolution in terms of the technology of radiation delivery, but the link with modern imaging continues to improve. And of course, we use a variety of imaging tools for other problems. For blood vessel problems, we use [INAUDIBLE] geography as well. Certain patients, we can add PET data, things like that.

So better imaging integration, faster dose planning-- when we started doing these cases, it might take us three hours to plan a case in 1987 where nowadays, we can probably plan treatment of some of the examples that I showed in 20 minutes. So total treatment time could be wheels in to wheels out for gamma knife for an acoustic neuroma in two hours.

JUSTIN: Great, thank you. You mentioned training a couple of times here, and we have a couple of questions about training. Dr. Lunsford, you are an exceptional teacher and mentor. What qualities do you think the best mentors and teachers have?

DADE LUNSFORD: Well, you hope that those are able to guide and teach by example to some extent. I've always had the feeling that respect is something that you earn. You can't command it. You can't say I want to be respected. You've got to earn it.

And I think that what we've done in a lot of our clinical outcomes and research, and we've published over these years some 1,000 papers, is that we've gone to our students and our residents, and we said, we've done this to 300 patients. Here's the data. Here's the charts. Here's the records. Now you go back and look at this and tell me if what we did was proper, correct, or the right thing to do.

And I don't go into this concept with, well, this is what I want it to look like. They have to take that data and prove it. And so we've given them free rein related to this. And that's paid off because all of our trainees, many of our medical students at Pit get involved in projects.

We give them full access to our database. The electronic medical record has helped some of that a little bit, but we've maintained individual records for 16,400 patients dating from 1987. And that allows us to go back 32 years, long before the development of electronic medical records to be able to follow up on patients over time.

JUSTIN: OK, great. Thank you. What should patients know about your field? What doesn't get enough attention?

DADE LUNSFORD: Well, the volume of clinical outcomes research is so huge and the number of journals and the number of publications and the number of books and abstracts and webinars and things like that. It is almost too much for any individual to master.

I think it's going to be increasingly true that for certain less common problems-- and acoustic neuroma is an incidence of, say, 1 per 100,000 people in the US. It may be a little greater now that MRI is widely available. They're found a little bit sooner-- that they're going to have to be people who concentrate on subspecialty aspects of things and that those people are going to be committed to doing long-term research to be able to, again, demonstrate the value.

My own belief is that in neurosurgery as a field, you could train a bunch of neurosurgeons to do probably 80% of what neurosurgeons need to know how to do probably in five years. And then, there's a core additional group who, with another two years of subspecialty training, focused on individual problems in clinical neuroscience would become regional or even national or international experts in that particular problem.

And the patients need to be able to reach those doctors. And that's one of the problems, of course, that we have. The type of insurance that an individual has may restrict access to people who have spent a lot of time working on individual problems. So there are a bunch of these things that can be solved.

Turf issues are a big problem. And in modern medicine, we as a team, just like in the skull base team here, works is really an integrated unit with different specialists from different education backgrounds. And we need to get away from turf issues, that this problem is always taken care of by this type of doctor, and this answer is always right because that's not always the case.

And always, we need to individualize what's right for the right patient. I tell residents, you've got to give it the mother or the mother-in-law test. If it were your mother, and you like her, or if it was your mother-in-law, I guess, if you don't like her, you've got to recommend what you as the expert think should be done for this patient in this context in this problem in this age group with this medical comorbidity. And always try to do what you think is going to be the best for the individual patients, but it's got to be based on outcome data that's documented that what you're recommending has merit.

JUSTIN: Great, thank you. A couple more here-- is there a role for observation of VS in young patients with small tumors, or do you recommend treating before hearing loss?

DADE LUNSFORD: Yeah, so that's a very important question. We try to get to that answer as to one of the things we searched for, especially over the last 10 years. The first thing we had to really solve with the management of this problem was the high risk of facial nerve damage because in our society, a face that doesn't work is a real impediment to socialization, to work environments, and things. So that really got solved, less than 1% risk.

The next question was, how can we do to save hearing, and what we tried to do with looking at these patients is look at the various factors that can impact how well they do. And there's no question that younger patients with smaller tumors treated within 2 to 2 and 1/2 years of diagnosis, those with the best hearing, those patients have the best chance of hearing preservation at a useful level, and that can reach levels as high as 80% to 90%. This is a very small subgroup of patients, patients who were not observed for a period of time, patients whose tumors had not grown significantly in this time.

One recent data from Dr. Ogino, one of our Fellows, has looked at the fact that as the tumor moves from the size of a canned green pea, let's say five or six millimeters, to the tumor the size of the green pea to a tumor that fills up the whole bony canal where the hearing nerve is-- called intracanalicular tumor-- the hearing preservation results steadily deteriorate.

So in our experience, if you want to save your hearing, if that's important, and for most people, it is, don't wait. But if you are going to wait, get a scan in six months. Don't take the advice, eh, that's a benign tumor. It's never going to bother you. Forget it. Get another scan in six months. Get another hearing test, and at very least, if you see any change or if you see any worsening of hearing, don't wait.

JUSTIN: Very good, thank you. Please talk about other techniques for delivering stereotactic RS like CyberKnife. Is that comparable?

DADE LUNSFORD: So there are several technologies that are based on using photon radiation delivered by linear accelerators. The CyberKnife is a technique developed by a neurosurgeon. Actually, he and I studied at the same place in Sweden many years ago, very innovative guy, John Adler, who developed the concept we could attach a linear accelerator to a robotic arm like you build cars with and rotate the radiation delivery around the head, focus on the tumor.

Now, most of the technologies using linear accelerators do not provide the same dose distribution or the fall off of the dose outside of the target in a sufficient way that they can to keep the same outcome or risks as the gamma knife does. And that's why we didn't-- we've never abandoned it.

What that means is, to get around that, they typically divide the treatment into three or five different radiation stations, and in some centers, it's being done with a full 30 fractions of radiation. There is no data at this time that the results are equivalent to what we and other centers have reported related to gamma knife.

And the only other real option, which is periodically mentioned because it's a hot topic because proton radiation or proton beam radiation is being bought by some medical centers with an installation cost varying from $50 to $300 million, that this form of radiation, which is used as accelerated protons to deliver the radiation effect, somehow has a better biological response in certain tumors. But at the present time, there's absolutely no supporting data to show that.

Interestingly, we don't have any database which actually knows how many patients are receiving other forms of radiation using stereotactic linear types of techniques. The only database that exists on a national basis is in patients over the age of 65, and the vast majority of patients with this tumor were actually diagnosed before the age of 65.

So we don't know how many have been treated by other techniques. We don't know what the results are except for isolated reports from this. And that's the reason that we have not switched to using this type of technique even though, to some extent, the overall government oversight of techniques like gamma knife works much, much higher level than the oversight of radiation delivered by a linear accelerator or proton technique.

JUSTIN: OK, Dr. Lunsford, I think we have room for one more question. I think it's a good one. And then we'll throw it back to Dr. Friedlander to wrap it up for us. To what do you attribute UPMC's track record of innovation in neurosurgery?

DADE LUNSFORD: Yeah, that's an excellent question. Of course, UPMC has changed a lot over the years that I've been here. When I came here, it was one single hospital, Presbyterian Hospital. And even at that time, there was sort of a competitive nature between the hospitals, which eventually got folded into this enormous enterprise called the UPMC.

Whether it's serendipity, being the right person at the right time, when I came here to put this concept up-- it actually took about seven years after I started on the faculty to get this started with the gamma knife-- the hospital administrator at that time was a guy who was interested in innovation. And at that time, there was no outcome data. There were only five gamma knives in the entire world. The one at UPMC became number five. And somebody had to take a risk.

So if the medical and the administrative leadership of an institution understands the value, then the ability to innovate remains. Actually, I had a system-wide committee called the Technology and Innovative Practice Committee at UPMC, which oversees these types of proposals at an entire variety of all the UPMC hospitals.

A lot of stuff with heart, a lot of stuff with endovascular technologies, general surgical technologies, laparoscopic advances, all of these things come to the committee with, all right, let's give it a shot. Let's do 10 cases, and let's see what you find. Is it safe? These are all approved technologies.

All have FDA approval, for example, but they cost money, and it takes a hospital with the guts to be able to say, OK, we want to stay on top. We want to be thought leaders. We want to be innovators. This is a format by which we can do it. You show me that it has potential value. We'll give it a test. And if it works, then we'll put it into the system.

JUSTIN: Great, thank you. I couldn't think of a better question to end on. Dr. Friedlander, you want to wrap up here for the day? Thank you.

ROBERT FRIEDLANDER: All right, thank you, Justin. And thank you, Dr. Lunsford. Really a phenomenal presentation, and I wanted to frame what the impact of Dr. Lunsford has been in neurosurgery. And as an example, let's talk about that Hollywood producer he was commenting on with a small acoustic neuroma.

In neurosurgery and in general, the traditional thought is that if something is small and asymptomatic in general is that we watch it, and examples of that abound in neurosurgery like small aneurysms or small, benign brain tumors. And the prudent path usually is to watch it and follow it, and if it changes, then we do something about it. There's a small risk that something bad will happen while we're waiting.

But with a small tumor like this, the acoustic neuroma, Dr. Lunsford really has changed the paradigm as to what to do with these lesions. He's proven the right way, which is looking at research, looking at outcomes, and very, very carefully following his many, many patients that are being followed for many years and really has changed the way that we think of these tumors as well as the resection followed by radiosurgery, all the different things that he described.

He's really done it the right way, which is to very, very thoughtfully and carefully follow all of his patients. And everybody knows, his results are what they are. They're honest, and he portrays them as they are. So this is a really great example of what he's done and really the spirit of the department of neurosurgery at UPMC, which as Dr. Lunsford mentioned, is to innovate, to change, to move the field forward. We don't want to be followers. We're not followers. We're leaders. We want to change the paradigms.

Another component that he mentioned is how we work as a team. We're a very, very large department, incredibly busy, largest department in the country. And what that allows us to do is to be extremely subspecialized. The neurosurgeons in our department are very, very specialized, treating many, many patients with very similar types of diseases that allows us to be technically very good to diagnose problems in a way that possibly others can't just because of our level of experience.

But in addition, we work in a multidisciplinary fashion. What we do is, even though a patient might come to see one neurosurgeon, what we do is we refer it to whomever we think is the best person in the field. So we work in the multidisciplinary fashion. We work as a team, and that is really what I believe sets us apart from anybody else. So it's the size. It's the specialization. It's the technological advances and the desire to really move the field forward.

So on that note, I'd like to end the session. I want to wish you all a great week. Stay safe, wash your hands, and we'll see you back next week. Have a good weekend.