

[MUSIC PLAYING]

JAN BUCKNER: Central nervous system tumors are rare, in the overall scheme of things. They involve both the brain and spinal cord.

FREDRIC MEYER: There are 120 brain tumors that adults and children can suffer from. We have perhaps the largest neurosurgical practice in North America, which means we have great expertise and depth in managing the most complex tumors.

JAN BUCKNER: Although they may be rare, at Mayo Clinic, they're not rare. Our specialized teams are comfortable seeing these rare types of tumors day in and day out.

FREDRIC MEYER: We have a team of neuroradiologists who have developed leading MRI technology and programming to help us diagnose brain tumors. There's a whole host of range of technologies that have been developed here that are unique and leading the way nationally. Some of those technologies would include MR spectroscopy, MR perfusion, MR diffusion, very multi-dimensional approaches to looking at a patient's problem.

SAMEER KEOLE: PET imaging is an incredibly useful tool in cancer care. Different isotopes give different value. But if they have a short half life, the only way you can inject them into a patient is if you have a cyclotron on site. We have a cyclotron on site.

JAN BUCKNER: One of the problems with imaging and brain tumors is interpretation of the imaging. At Mayo Clinic, we have a more comprehensive way of obtaining the images, of getting all of the information we can possibly get from the image in order to know if this is a truly recurrent tumor, progressive tumor. Or on the other side, is that an artifact of apparent reduced tumor size when it's just the effect of therapies?

FREDRIC MEYER: One of the techniques which we have developed here is using awake brain surgery and very complex mapping of the brain surface in the descending white matter tracks to try to preserve neurological function. It's important to remember that the closer a tumor or an epileptic focus comes to functioning brain tissue, the higher the risk. So when that risk is close, when those anatomies are close, we use awake mapping to try to prevent harm to a patient.

ALFREDO Image guidance-- doing minimally invasive brain surgery-- it's crucial to be able to not only

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HINOJOSA:** understand the anatomy of the brain, but to be able to navigate, and getting into all those difficult, little places where function is extraordinarily important. And a lot of these new software modalities, like functional MRI, allow us to have a preconceived idea of the dangerous parts of the brain. So when you go in, and you want to take a tumor out, for instance, you have an idea as to which areas you should and should not touch. Those that should not be touched, most likely they need to be left behind so that patients have a much better outcome in the long term.

FREDRIC MEYER: In certain types of brain tumors, especially at the base of the skull, there's anatomy that needs to be protected, like nerves that are responsible for vision, for talking, and so forth. Using a Gamma Knife, for example, allows one to radiate that tumor mass or protect the surrounding brain tissue.

SAMEER KEOLE: The key is, what's surrounding that target? That's where proton beam excels. The proton beam can spare normal, healthy tissues, including those in the brain, by anywhere from 70% to 99% versus our best x-ray techniques.

JAN BUCKNER: One of the most exciting developments recently has been improved molecular diagnostics for brain tumor. Mayo Clinic scientists were instrumental in developing a new classification system for gliomas.

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HINOJOSA:** We can take the tumors out, we can send them to the laboratory, understand the different molecular pathology and molecular biology of these cancers. But when it comes down to it, what we're trying to do is trying to enhance how we personalize medicine. And how is precision medicine better utilized for the care of the patient? Every patient has a different molecular subtype. Our understanding in the lab is allowing us to understand how we can treat every patient individually. New molecular biology tools have allowed us to nowadays understand how cancer cells migrate, not only in the brain, but other parts of the body.

JAN BUCKNER: Not only is each individual tumor unique to that patient, but it continues to evolve. It can evolve down different pathways. And it is possible to build a mutational tree so that we understand in which direction the tumor is mutating, and develop therapies appropriately.

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HINOJOSA:** And these molecular changes are extraordinarily important to understand, so that way we can put the brakes on those cancers. In our laboratory, with our team, we have patented multiple technologies, multiple drugs can actually play a role in blocking and stopping the cell migration.

FREDRIC MEYER: We have a broad range of clinical trials to treat patients with brain tumors across Mayo Clinic. Some of them are chemotherapy, some are radiation. But some of them are also viral therapies and immunotherapies.

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HINOJOSA:** The Mayo Clinic is at the forefront of utilizing stem cells that we get from either fat from our own body or from our own bone marrow. You can use stem cells, especially with the way we have used them in our laboratory. It's as Trojan horses. We can actually load treatments into these stem cells that we get from our own fat. And we have proven that these stem cells like little Trojan horses go in there into parts of the brain, localizes a bad cancer cell, and delivers a cargo.

SAMEER KEOLE: I think as we move into new therapies, including immunotherapies or vaccine therapies, then that really allows us to leverage the body's immune system to help us fight the tumor. And so the goal is really going to be to try to treat the tumors, but really leave the patient in even better shape after their fight with the cancer is done.

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HINOJOSA:** So not only are we talking about personalized medicine, but more importantly, we're talking about precision medicine. Because at the end of the day, your body is the best tool that can heal your own body.