

Melanie Cole, MS: Welcome to the podcast series From the Specialists at Penn Medicine. I'm Melanie Cole. Joining me today is Dr. Christina Jackson. She's an assistant professor of neurosurgery at the Hospital of the University of Pennsylvania, and an assistant professor of otolaryngology head and neck surgery at Penn Medicine.

I'd like to remind our listeners before we begin that anyone interested in reaching out directly to the skull base surgery program at Penn Medicine directly can call the program patient coordinator at 215-662-6638 or email the program at neurosurgery@pennmedicine.upenn.edu.

She's here to highlight endonasal approaches to skull-based surgery for us today. Dr. Jackson, it's a pleasure to have you join us. Endoscopic endonasal neurosurgery has been around for some time, but the procedures you're performing, including contralateral transmaxillary approaches and pituitary transposition are relatively new. Can you describe these procedures, their benefits and what makes them so unique?

Christina Jackson, MD: Thank you very much for having me today, Melanie. I'm very excited to share some of the work that we're doing in advanced endoscopic endonasal approaches here at Penn. When this technique was first introduced and gained more widespread views, the main pathology that we were able to treat was really limited to pituitary tumors along the midline of the skull base.

As endoscopic endonasal surgery continues to evolve and advance, we're now able to tackle many more pathologies through these approaches in addition to pituitary tumors. Such as meningiomas, craniopharyngiomas, chordomas, and chondrosarcomas. Many of these tumors are in locations that were previously considered inoperable, or couldn't be operated on without significant morbidity and risks.

The contralateral, transmaxillary, and pituitary transposition techniques are some of the nuanced approaches that allow us to expand what we can accomplish through the endonasal corridor to reach new areas. They also allow us to do this in a more safe, but also minimally invasive way. The challenges to these deep-seated skull-based lesions are that they're difficult to reach and are often surrounded by critical neurovascular structures.

Some of the limitations of endoscopic endonasal procedures previously were how lateral we could reach along the skull base due to the natural limitation of the borders of the nostril. And this also previously limited our access to lesions that are tucked behind normal critical structures. The contralateral transmaxillary approach expands our utilization of our natural paranasal sinuses to include the maxillary sinus, and we used this as a natural corridor actually from the opposite side of the tumor, which allows us to reach the far-most

lateral extent of the tumor that we couldn't reach previously, including tumors that are tucked behind the internal carotid artery.

This involves creating a very small incision above the patient's gum that allows us direct access to the maxillary sinus. This conduit is then connected to the nasal corridors of a standard endoscopic endonasal approach that allows a more favorable angle for our instruments and lighted cameras to reach the lesion.

The other area that has been difficult to reach historically is the location directly behind the pituitary gland. Traditional open approaches to this area requires the surgeon to transgress cranial nerves. Endonasal approaches previously were limited by the pituitary gland in terms of reaching this region.

Pituitary transposition allows us to mobilize the pituitary gland out of the way to be able to reach this area. This involves releasing the pituitary gland from its natural confines safely so that we can look behind it and tackle tumors in this area without putting nerves at risk. These innovative approaches allow us a more direct route to these lesions with less risk to neural and vascular structures that often limit traditional open craniotomy approaches. They also minimize large invasive incisions and brain retraction that allow patients a faster recovery without a scar.

Melanie Cole, MS: Such advanced medicine, Dr. Jackson, you recently had some very interesting cases, including a woman with a very rare malignancy near her internal carotid artery. What made this case so difficult and how was it resolved? I understand she went home the day after surgery.

Christina Jackson, MD: Yes. this was a patient who had a rare tumor called chondrosarcoma, who actually traveled from another state in particular for our expertise in these advanced approaches. Skull-based chondrosarcoma typically arise from and are located in a region called the petrousclival or petrousapex region. These regions are among some of the most difficult areas for us to reach surgically.

Previously, our ability to achieve a total resection in this area was limited, and for these tumors, maximal resection is critical to minimize the risk of recurrence of tumor. What makes these cases difficult is that the relationship of the tumor to the carotid artery and cranial nerves are intimately involved. From a craniotomy, the cranial nerves are often in the way, and traditionally from an endonasal corridor, the carotid arteries in the way. With a traditional open approach, it would require a very large incision, extensive bony removal around the carotid artery and retraction of the brain to really reach this deep location.

Resection of the tumor will also involve transversing cranial nerves. And even then, it'll be very difficult for us to achieve a complete resection before patients are often recovering for weeks and sometimes months from these procedures. Now, we're able to use the contralateral transmaxillary approach, and this is

what we did for this patient, using this approach in conjunction with traditional endoscopic endonasal approaches, we were able to access the tumor behind the carotid artery safely without manipulation of the artery to be able to remove the tumor completely. This is accomplished with a two-surgeon, four-handed technique with our ENT partners, with significant experience working in sync together through these corridors.

Patients typically tolerate these procedures very well without brain retraction or painful incisions. This patient was in the hospital, like you said, for one night, and was able to go home the following day. She was back to her hobbies playing golf by the time she return to clinic to see me about two weeks after surgery.

Melanie Cole, MS: Amazing. That's just incredible. So what's involved in pituitary transposition? Can the pituitary, which sits in a sort of dedicated pocket in the skull actually be moved? Tell us a little bit about that.

Christina Jackson, MD: Of course. So, one advancement in our ability to carry out these new approaches is really our improved understanding of the intricate anatomy of the skull base. And this is done through hours of careful dissection in the anatomy lab, something that we do on a routine basis here at Penn. And this is an invaluable experience in this field.

The front of the pituitary gland is actually covered by two distinct layers of dura, which is the covering of the brain. However, on each side of the pituitary gland, these two layers actually split and are separated by venous-filled spaces called the cavernous sinus. We can take advantage of these venous-filled spaces to separate the two layers of the dura, the covering, and separate the attachments that usually holds the pituitary in place along each side.

Once the attachments are released, the pituitary gland, which is still protected with the inner dural layer, can be mobilized, readily lifted up to reach the pathologies behind it. This technique requires highly specialized trained surgeons who fully understand the anatomy of this complex region. And the surgeons here at Penn are specially trained in these complex techniques.

Melanie Cole, MS: Well, endoscopic endonasal surgery has become a genuinely multidisciplinary effort in recent years. Doctor, is this a reflection of the multi-step complexity of the surgeries and who's involved in the program at Penn Medicine? Speak about that multidisciplinary approach.

Christina Jackson, MD: I completely agree with what you just said. These cases and approaches are technically challenging and are at the intersection of multiple different specialties. This includes neurosurgery, otolaryngology, as well as oculoplastic surgery. This multidisciplinary effort is one of the reasons I pursued this specialized field in the first place.

This truly becomes a partnership that requires a deep level of commitment from all members of the group. In particular for endoscopic endonasal cases, they're always done together with neurosurgery and otolaryngology where we are learning from each other and are discussing and performing each aspect of the surgery together, including the approach, resection of the tumor, as well as the reconstruction.

We perform a high volume of these cases and are very used to working together. This team-based approach allows us to select the best surgical approach for each patient and each tumor to offer the best surgical outcomes. While our topic today is focused on endoscopic endonasal surgery, the Penn Skull-based program is a comprehensive program including specialists in neurosurgery, rhinology, otology, head and neck surgery, oculoplastic, as well as radiation oncology.

We're able to provide the full array of options of cutting-edge treatment for skull-based diseases in addition to minimally invasive approaches.

Melanie Cole, MS: Doctor, what other new approaches for minimally invasive surgery are on the horizon at Penn Medicine? Give us a little blueprint for what you see happening in the next 10 years or so.

Christina Jackson, MD: Sure. Another area that I'm really excited about, is our involvement in partnership with our oculoplastic colleagues. One area of the skull base that is also intimately involved is the orbit. And therefore we're partnering with our ocular plastic colleagues to expand our transorbital approaches for skull-based tumors here at Penn.

These approaches allow us to use the natural creases of the eyebrow and eyelid to reach tumors without a large scar and often provide a more direct path ~~two~~ to these tumors. We already work closely together with our oculoplastic colleagues on larger combined cases where the tumor spans both the orbit and intracranial compartments.

Therefore, this is a natural partnership to develop a more minimally invasive approach to skull-based tumors for our patients.

Melanie Cole, MS: This is such an interesting topic, Dr. Jackson. Finally, you've had patients arriving at Penn neurosurgery from distance states for surgery. How can these patients and their clinicians reach out to you in the skull-based program for more information?

Christina Jackson, MD: For patients who would like to seek expertise from our skull-based team or clinicians who would like to refer their patients to see us, they can reach our program directly through our skull-based patient coordinator at 215-662-6638 or email us at neurosurgery@pennmedicine.upenn.edu.

Melanie Cole, MS: Thank you so much, Dr. Jackson for joining us today and telling us about all of those interesting advances in endonasal approaches to skull-based surgery. That concludes this episode From the Specialists at Penn Medicine. I'm Melanie Cole. Thanks so much for joining us today.