MAYO CLINIC

Endocrinology Update

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In this issue

Elucidating a Rare Pituitary Cancer

Spindle cell oncocytoma (SCO) of the pituitary gland is a rare posterior pituitary neoplasm. Although classified as a grade 1 tumor, it has clinically aggressive features, including hypervascularity and tenacious recurrence. An optimal treatment strategy has yet to be elucidated.

Based on a review of 85 cases, Mayo Clinic neurosurgical researchers have identified clinical, radiographic (Figures 1, 2 and 3) and pathological features of SCO. The study, published in *World Neurosurgery* in 2021, also describes possible treatment strategies.

SCO is challenging to diagnose preoperatively, due to its radiographic resemblance to other pituitary tumors.

The Mayo Clinic study found that severe hyponatremia — with its associated fatigue, nausea and emesis — may be present in individuals with SCO. A highly vascular, posteriorly placed tumor that displaces the pituitary gland or stalk antero-superiorly might also indicate SCO.

Surgery is complicated by tumor location and by the tumor's hypervascular, fibrous and adhesive nature. SCO is frequently located behind the anterior lobe.

Cavernous sinus extension is common. The researchers found many cases in which heavy intraoperative bleeding resulted in incomplete resection or massive blood loss or both.

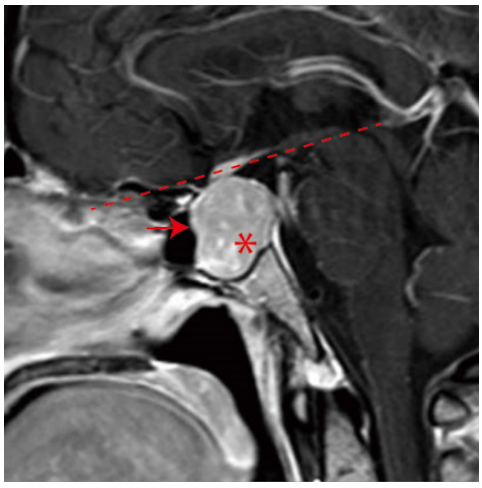

Figure 1. Preoperative image of a patient with spindle cell oncocytoma shows peculiar features of the cancer. The pituitary gland is anteriorly displaced (arrow). There are numerous curvilinear contrast enhancements inside the tumor, suggesting intratumoral vessels (asterisk). The pituitary stalk is displaced more horizontally than usual (dashed line).

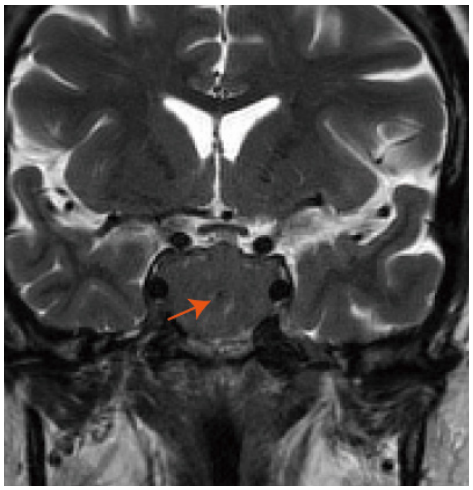

Figure 2. T2-weighted image shows a spotty hypointensity inside the tumor (arrow).

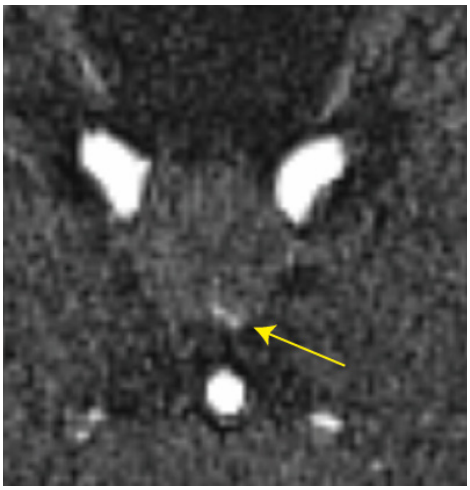

Figure 3. Intratumoral flow signal (arrow) can be seen on magnetic resonance angiography.

Among the SCO cases studied, gross total resection (GTR) was achieved in only 24% of patients. The tumor control rate five years after treatment was 75% when GTR was achieved, compared with 24% after non-GTR.

The researchers note that radiotherapy might help decrease tumor progression: Patients who had radiotherapy following non-GTR had a tumor control rate of 76% after five years. However, if GTR isn't achieved and radiotherapy isn't performed, 50% of tumors show significant progression and require further treatment within about two years. Multiple recurrences happen in 20% of these patients, and even distant metastasis is possible.

The researchers further note that long-term follow-up is needed for all patients and that the rate of progression raises questions about the SCO's classification as a grade 1 tumor.

FOR MORE INFORMATION

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Pituitary Tumors: Patient-Centered Care Facilitates Strong Outcomes

Jamie J. Van Gompel, M.D.

Dana Erickson, M.D.

Jason T. Little, M.D.

Mayo Clinic stresses multidisciplinary and patient-centered management of pituitary tumors, generally resulting in fewer surgical complications and shorter hospital stays. Approximately 82% of patients are sent home the day after surgery.

The type of surgery performed is tailored to an individual's needs. "No single person controls our pituitary tumor practice. Our multidisciplinary team ensures that many eyes and ears are going over each patient, from pre-surgical to post-surgical care," says Jamie J. Van Gompel, M.D., a neurosurgeon at Mayo Clinic in Rochester, Minnesota.

Mayo Clinic has neurosurgeons with expertise in both microsurgical and endoscopic pituitary tumor resections. Nationwide, the endoscopic approach is increasingly favored — although its impact on improving patient care hasn't been elucidated. A retrospective study comparing 534 microsurgical and endoscopic pituitary tumor surgeries at Mayo Clinic between 2014 and 2019 documented a similar number of patients having each procedure.

The study, published in the August 2021 issue of *Mayo Clinic Proceedings*, set out to document the advantages and disadvantages of the microscopic and endoscopic approaches performed at a single center. Among the patients studied, one neurosurgeon performed all microscopic resections and a second neurosurgeon performed all endoscopic procedures.

The study demonstrated that both approaches are safe and can substantially benefit patients. "In experienced hands at an experienced center, the overall outcome of pituitary tumor surgery is excellent, whether the procedure is done with a microscope or an endoscope," Dr. Van Gompel says.

The study also found differences between Mayo Clinic's outcomes and those reported in a multicenter study published in the March 2019 issue of the *Journal of Neurosurgery*:

- 3.4% of Mayo's patients were readmitted to the hospital within 30 days of surgery compared with 9.5% of patients treated microscopically and 6.3% treated endoscopically in the multicenter study.
- Hospital stays averaged 1.3 days at Mayo Clinic compared with three days reported in the multicenter study.
- Mayo Clinic had significantly shorter operating times, with microsurgery averaging 83 minutes and endoscopic procedures averaging 131 minutes — compared with 219 minutes for microsurgery and 293 minutes for endoscopic procedures in the multicenter study.

"Our patients did very well, with few secondary treatments," Dr. Van Gompel says. "Pituitary tumors were commonly taken care of with one operation."

EXPERTISE IN ENDOCRINOLOGY AND NEURORADIOLOGY

Mayo Clinic is committed to multispecialty management of pituitary tumors. Neurosurgeons, endocrinologists and neuroradiolo-

gists have interdisciplinary conferences to determine the correct diagnosis and optimal treatment in challenging cases.

The endocrinologists — part of Mayo Clinic's Pituitary-Gonad-Adrenal (PGA) Specialty Group — are typically the first physicians to see patients with pituitary tumors.

"Our wealth of experience allows us to provide state-of-the-art care to patients with all types of pituitary tumors," says Dana Erickson, M.D., an endocrinologist at Mayo Clinic in Minnesota. "We provide a comprehensive clinical assessment that focuses on the patient as a whole, including evaluation of comorbidities associated with functional tumors or hypopituitarism."

Dynamic pituitary testing is performed in Mayo Clinic's Endocrine Testing Center. In the setting of Cushing syndrome, endocrinologists work closely with neurosurgeons and neuroradiologists to organize inferior petrosal sinus sampling and 7-tesla MRI.

"We have made great strides with our clinical 7-tesla imaging," says Jason T. Little, M.D., a neuroradiologist at Mayo Clinic in Minnesota. "A known drawback of scanning at 7-tesla is the characteristic artifact from the skull base, which can obscure the pituitary gland. But working with our MRI physicists, we have been able to mitigate that artifact with our 7-tesla scanner."

Mayo Clinic also uses 3-tesla MRI with dynamic contrast as needed. "That allows us to detect subtle but clinically important small pituitary tumors," Dr. Little says.
The multidisciplinary team recommends surgery, medical treatment or active surveillance. If surgery is needed, the microscopic and endoscopic approaches offer differing views of pituitary tumors (Figure).

Mayo Clinic's study confirmed that the endoscopic approach generally provides a larger percentage of tumor resection. Nevertheless, both approaches achieved a high volume of tumor resection: 87% for microscopic procedures and 92% for endoscopic procedures.

"Our group has previously published that 85% resection is commonly needed to avoid secondary therapy, and we exceeded that level with both approaches," Dr. Van Gompel says. "Larger or more-invasive tumors probably benefit from an endoscopic approach. But for tumors that are likely to measure less than 2 centimeters and are confined to the pituitary gland, the technique doesn't matter much."

Post-surgical complications among patients in the study were generally low:

- 0.4% of patients developed post-surgical infections.
- Approximately 2% of patients had post-surgical cerebral spinal fluid leaks compared with 4.9% of patients treated microscopically and 3.4% treated endoscopically in the multicenter study.
- 8% of Mayo Clinic patients had new anterior pituitary dysfunction, and 2.8% had permanent posterior dysfunction.

Mayo Clinic provides extensive follow-up care for patients who have pituitary tumor surgery. A nurse specializing in pituitary care offers postoperative patient education. Other follow-up care includes imaging studies, hormone replacement therapy

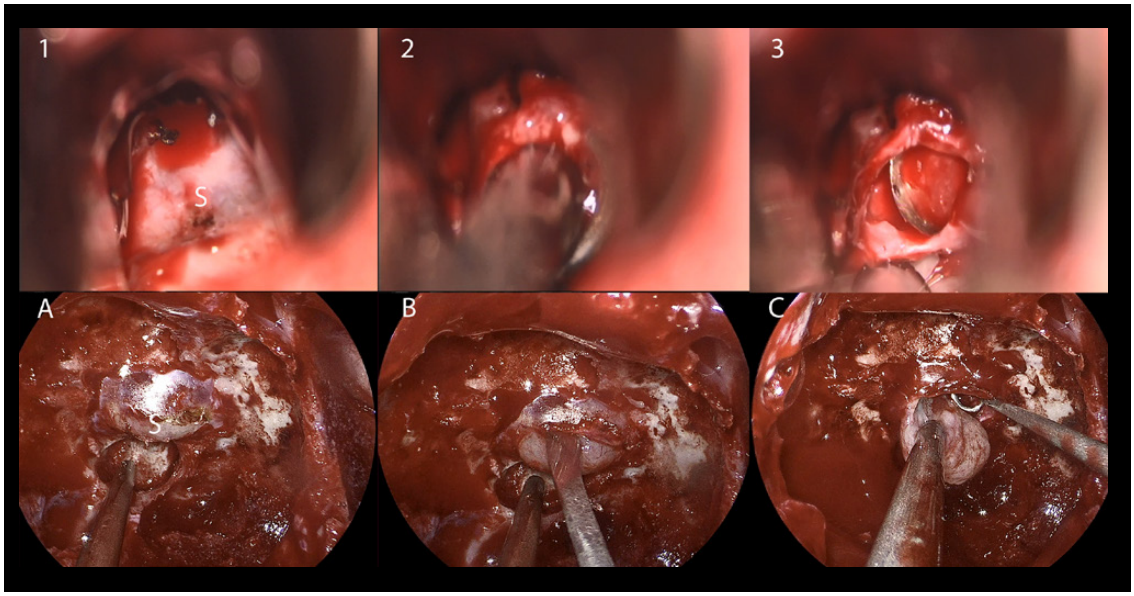

Figure. Photographs taken during a microscopic pituitary surgery (top) and an endoscopic pituitary surgery (bottom) show the surgical exposures in patients with similar midline macroadenomas. 1. Photograph shows the view with the microscope through a speculum to the face of the sella. 2. The surgeon brings the tumor midline through the dural opening to suction for resection. 3. The surgeon uses a curet to look through the microscope to assess the gland after the tumor's removal. A. The view of the sella in the endoscopic procedure is comparable to the microscopic exposure seen in 1. B. The surgeon dissects the gland upward off the tumor with a dissector rather than using intratumoral resection, as was used in the microscopic procedure. C. The extracapsular bimanual resection of the pituitary tumor off the gland continues, with a suction and curet similar in size to the curet seen in 2. Image reprinted with permission from *Mayo Clinic Proceedings*.

for hypopituitarism and adjuvant therapy if persistent disease is present in cases of functional tumors.

"Safe care can be delivered over time by a large, multidisciplinary group that specializes in pituitary practice," Dr. Van Gompel says. "Patients can benefit substantially, with low numbers of complications and a reduction in the number of treatments needed."

FOR MORE INFORMATION

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Mayo Clinic Clinical Trials in Patients With Tumor-Induced Osteomalacia

Jad Sfeir, M.D., M.S.

Alicia Algeciras-Schimnich, Ph.D.

Matthew T. Drake, M.D., Ph.D.

Oncogenic osteomalacia, also referred to as tumor-induced osteomalacia (TIO), is a rare disorder characterized by urinary phosphate wasting due to an increased production of fibroblast growth factor 23 (FGF23) from an underlying mesenchymal tumor. This wasting results in a significant reduction in serum phosphate and leads to bone pain, muscle weakness and skeletal deformities, as well as recurrent fractures. These symptoms cause significant disability and morbidity in patients with this disease.

The main challenges with patients with TIO are the identification of the disease and the localization of the FGF23-producing tumor.

"It is very common for TIO to remain undiagnosed for several months or years, largely owing to the nonspecificity of the presenting symptoms as well as limited awareness of the disease," reports Jad Sfeir, M.D., M.S., Endocrinology, Diabetes, Metabolism, and Nutrition, at Mayo Clinic in Rochester, Minnesota.

On average, TIO is diagnosed 2.9 years after the onset of symptoms. The most widely available assays measuring serum or plasma FGF23 detect the carboxy-terminal fragment. Recently, an assay measuring the biologically active intact molecule has been developed. "The intact FGF23 assay is available at Mayo Clinic Laboratories, and we are collecting samples from patients with TIO to establish its clinical performance," confirms Alicia Algeciras-Schimnich, Ph.D., Laboratory Medicine and Pathology, at Mayo Clinic in Minnesota.

"There is also a big gap in time between the diagnosis of TIO and the identification of the underlying tumor of an average of 5.4 years, with some reports of patients waiting as long as 40 years before the tumor was resected," adds Matthew T. Drake, M.D., Ph.D., Endocrinology, Diabetes, Metabolism, and Nutrition, at Mayo Clinic in Minnesota. Resection of the tumor is usually curative as it removes the source of excess FGF23, and thus timely localization of the tumor is essential.

DOTATATE PET-CT and other gallium 68 (68Ga)-conjugated somatostatin peptide analogues (Figure, see page 5) have been reported to localize FGF23-producing mesenchymal tumors. This technology has been validated for use in patients with neuroendocrine tumors but not in TIO.

An FGF23 monoclonal antibody (burosumab) was recently approved by the U.S. Food and Drug Administration for use in patients in whom surgical tumor resection is not possible. "Burosumab showed biochemical and clinical benefits in phase 2 clinical trials. However, since nonsurgical patients are likely to require long-term medical management, data on longer duration and larger scale use of burosumab in patients with TIO would help identify clinical recommendations for its use," concludes Dr. Sfeir.

CLINICAL TRIALS AT MAYO CLINIC

Current research related to FGF23-mediated oncogenic osteomalacia and FGF23 assays includes:

Ga-DOTATATE PET for localization of phosphaturic mesenchymal tumors in patients with tumor-induced osteomalacia
Mayo Clinic investigators are studying the

use of 68Ga-DOTATATE PET to localize the underlying mesenchymal tumor in patients with FGF23-mediated oncogenic osteomalacia.

Interested referring providers can contact Jad Sfeir, M.D., M.S., at *sfeir.jad@mayo.edu* and view additional information and study contacts at Ga-DOTATATE PET for Localization of Phosphaturic Mesenchymal Tumors in Patients With Tumor Induced Osteomalacia (NCT03736564). *https://www.mayo.edu/research/clinical-trials/cls-20438425*.

A study to evaluate intact FGF23 performance in patients with tumor-induced osteomalacia (TIO) and X-linked hypophosphatemia (XLH)
Investigators from Laboratory Medicine and Pathology at Mayo Clinic in Minnesota aim to establish the clinical performance of the intact FGF23 assays.

Interested referring providers can contact Stephanie S. Hafner, Laboratory Medicine and Pathology, Mayo Clinic in Minnesota at *hafner.stephanie@mayo.edu* and view additional information and study contacts at A Study to Evaluate Intact FGF23 Performance in Patients With Tumor-Induced Osteomalacia (TIO) and X-Linked Hypophosphatemia (XLH). *https://www.mayo.edu/research/clinical-trials/cls-20467392*.

FOR MORE INFORMATION

Mayo Clinic Laboratories. *https://www.mayocliniclabs.com*.

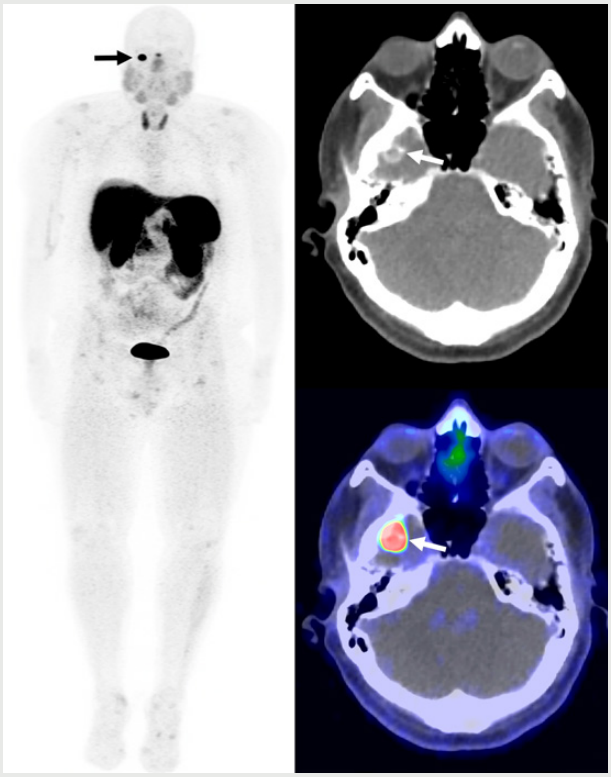

Figure. Whole-body maximum intensity projection, CT and fused PET-CT images from a gallium 68 (68Ga)-DOTATATE PET-CT demonstrate a calcified mass in the right middle cranial fossa with intense uptake (arrows). The mass was resected and confirmed to be a phosphaturic mesenchymal tumor.

All Adrenal Tumors Should Be Investigated, Says Study

The human body has two adrenal glands, one atop each kidney (Figure 1, see page 6). These tiny organs produce hormones that help the body function correctly and are vital for immune system and stress response. The adrenal glands can often do their job even if they develop a tumor. Mostly, the tumors are noncancerous and benign, but some are cancerous or can cause other serious health problems. Adrenal cancer, although rare, has poor five-year survival rates: around 50% to 60% if removed early and only 10% to 20% if metastasized.

In a 2020 publication in *The Lancet Diabetes & Endocrinology*, a team of international researchers describes the epidemiology of adrenal tumors in Olmsted County, Minnesota. The team used the Rochester Epidemiology Project, a medical research collaboration that allows population-based research on a level not possible anywhere else in the U.S. Based on those data, the authors recommend that all tumors, even those found secondary to the patient's main health concern, be fully evaluated for malignancy or contributions to hormone imbalance.

HISTORY OF ENDOCRINE EXCELLENCE

In the course of pursuing a doctoral degree at Aarhus University in Denmark, Andreas L. Ebbehøj, M.D., the study's first author, came to Mayo Clinic as a research trainee specifically to study this topic.

"International collaboration is key in research, especially in the world of adrenal research," he says. "And what place could possibly be better to go to than the birthplace of corti-

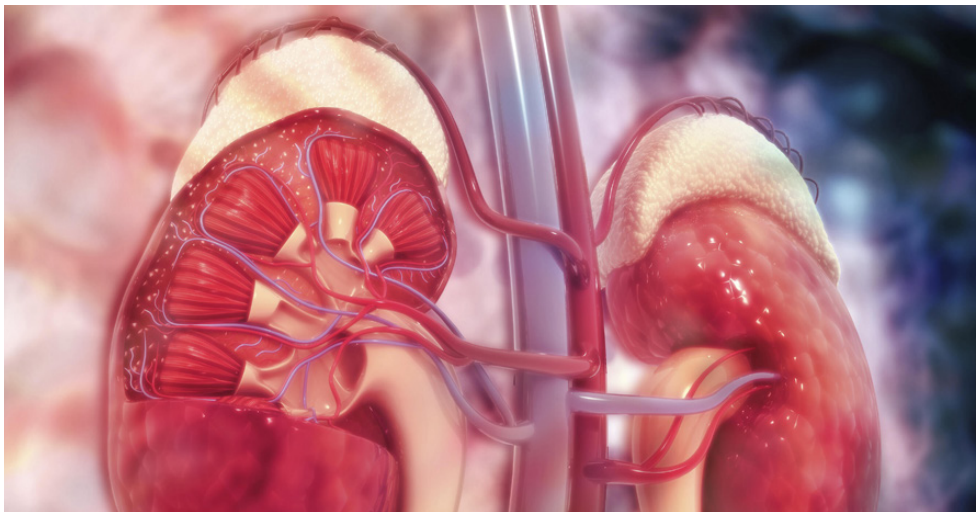

Figure 1. Adrenal glands.

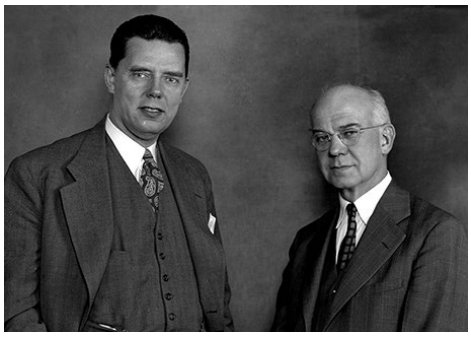

Figure 2. Pictured from left, Dr. Phillip Hench and Dr. Edward Kendall. Researchers knew about chemicals released by the adrenal cortex for years, but research in this area spiked with World War II on the horizon in 1941. To learn more about the development of "compound E" — now called cortisone — read Dr. Kendall's Nobel Lecture from 1950.

Figure 3. Authors who are currently affiliated with Mayo Clinic are Irina Bancos, M.D.; Dingfeng Li, M.D.; Ravinder Jeet Kaur, M.B.B.S.; Catherine D. Zhang, M.D.; Sumitabh Singh, M.B.B.S.; Elizabeth (Beth) J. Atkinson, M.S.; Sara J. Achenbach; Sundeep Khosla, M.D.; William Young Jr., M.D.; and Walter A. Rocca, M.D., M.P.H. Other authors are Andreas L. Ebbehøj, M.D., of Aarhus University Hospital in Denmark, as well as Taoran Li, M.D., Mount Sinai Morningside, New York; and Wiebke Arlt, M.D., University of Birmingham and University Hospitals Birmingham NHS Foundation Trust in the United Kingdom. Assistance for this project was provided by Barbara Abbott and colleagues from the Rochester Epidemiology Project. Funding and other support were provided by the National Institutes of Health and the Mayo Clinic Robert D. and Patricia E. Kern Center for the Science of Health Care Delivery. The study was accompanied in *The Lancet Diabetes & Endocrinology* by an editorial, "Understanding the Epidemiology of Adrenal Tumours."

sone, discovered by Drs. Philip S. Hench and Edward C. Kendall (Figure 2); the home of living adrenal legends, such as William Young Jr., M.D.; and last but definitely not least, the rising star and co-author of recent adrenal guidelines, Irina Bancos, M.D."

Dr. Young is the Tyson Family Endocrinology Clinical Professor in Honor of Dr. Vahab Fatourechi; Sundeep Khosla, M.D., is the Dr. Francis Chucker and Nathan Landow Research Professor; and Walter A. Rocca, M.D., M.P.H., is the Ralph S. and Beverley E. Caulkins Professor of Neurodegenerative Diseases Research (Figure 3).

Dr. Bancos, a Mayo Clinic endocrinologist, is the senior author of the study. She has clinical and research expertise in adrenal tumors and was concerned about the lack of epidemiology studies in adrenal tumors. She believed there was a substantial gap in what the medical community knew about these tumors.

"The simple but important thing we discovered was a population-based proportion of malignant tumors, which is very helpful when discussing management with a patient newly diagnosed with an adrenal mass," she says.

THE NUMBERS

Medical record review yielded 1,287 people diagnosed with adrenal tumors from 1995 to 2017. Due to increased use of medical imaging, the researchers found that diagnoses of any kind of adrenal tumor became 10 times more common by the end of the 23-year period (Figure 4, see page 7).

'INCIDENTALOMAS'

Some patients were diagnosed with adrenal tumors as a primary diagnosis, but many, especially in the later years of the study period, had incidentalomas — a combination of the word "incidental," meaning that the tumor was found while the patient was being examined for something else, and the suffix "-oma," which means tumor.

In the incidentaloma group — which accounted for about 81.5% of the tumors found — some had malignant adrenal masses (3.3%) and a smaller group had obvious signs of elevated hormones (1.9%). Because the benign tumors without apparent signs of hormone excess vastly outnumbered the other, more dangerous tumor types, "unfortunately our job of diagnosing the patients who might benefit from adrenal surgery just got a lot harder," says Dr. Ebbehøj. "We also found that the clinical presentation and tumor characteristics tell us a lot about the tumor and whether it is likely to be malignant or not. For example, adrenal tumors in children, or any patients with another type of cancer, should be considered malignant until proved otherwise." Larger tumors were more likely to be malignant, as well.

These findings are why Dr. Bancos and the team wanted to conduct this research. "I commonly see adrenal incidentalomas not considered important," says Dr. Bancos (Figure 5, see page 6). "In this study, we show that any adrenal mass should be properly evaluated for both malignancy and hormonal excess before dismissing this problem."

CALL TO ACTION

In addition to the findings about the type and prevalence of different adrenal tumors, the researchers learned about what diagnostic tools and treatments are employed across the health care community.

"Most previous studies on adrenal tumors have been conducted at specialized endocrine centers by physicians who know the diagnostic guidelines by heart or even co-authored them," says Dr. Ebbehøj.

By using data from the Rochester Epidemiology Project, the team was able to include all patients from the community diagnosed with adrenal tumors by all different types of health care providers.

"We were quite shocked when we learned that only 15.2% of patients had undergone the recommended biochemical testing for hormonal excess," say Dr. Ebbehøj.
A self-professed "adrenal nerd," Dr. Ebbehøj says he understands why this type of testing might be overlooked (Figure 6). After all,

many of the tumors found are incidental to a work-up for cancer or other "acute unpleasantries." However, because many other chronic conditions, such as diabetes, osteoporosis and cardiovascular diseases, can be caused by excess hormones, he urges colleagues to send patients for an endocrine work-up. "An adrenal incidentaloma offers the physician a chance to prevent or even cure a patient from these diseases, but only if properly worked up. Otherwise, the discovery ends up being a wasted opportunity."

"Our message is, again, to recognize the adrenal mass as a problem that needs full investigation at the time of discovery," reiterates Dr. Bancos.

THE VALUE OF EPIDEMIOLOGIC RESEARCH

This study is an example of descriptive epidemiology, examining incidence, prevalence, morbidity and mortality. It describes the scope of adrenal tumors, which helps shared decision-making with patients. Prognosis, or the likely course and outcomes of a disease, are part of physician-patient conversations when deciding how to proceed.

"In this particular case, the question of how common the dangerous adrenal subtypes are out of all the adrenal incidentalomas is key," says Dr. Ebbehøj. "For example, you see a patient with an adrenal incidentaloma. It does not appear to produce hormones, and it does not seem to be malignant. But should you recommend a follow-up CT scan and repeated biochemical testing to be sure, when you know this means extra radiation, patient anxiety and costs? Or should you recommend surgery to be on the safe side? We need good epidemiologic data to design rational guidelines that can balance between benefits and harms."

Dr. Bancos says she uses the results of this research daily when talking with her patients. "Clear understanding of the risk is very helpful in shared decision-making on the next steps in management.

"Outside the clinic, I agree with Dr. Ebbehøj that epidemiology data are extremely important for developing guidelines and proposing intervention. Understanding what test needs to be done, and which time and in which sequence, is not only likely to achieve better health outcomes for our patients and standardize and assure appropriate care but also to save health care costs."

The researchers hope their study can be an example to other specialties and spur understanding of the broader presentation of particular conditions. Patients seen at an academic medical center such as Mayo Clinic or Aarhus University Hospital do not represent the overall patient group that is being managed by primary and secondary health care providers.

"Just like we need to include different sexes and races in our research, we should also consider whether our results are applicable outside our own specialized niches," says Dr. Ebbehøj.

"I completely agree," says Dr. Bancos. And now that she has evidence expanding the understanding of adrenal tumors, she hopes to see widespread practice change.

FOR MORE INFORMATION

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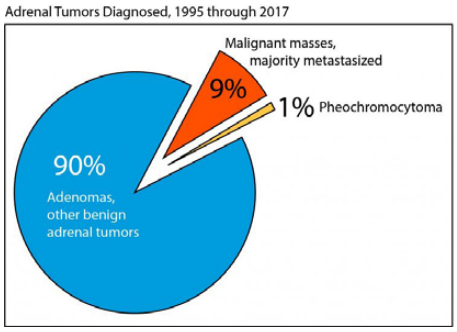

Figure 4. The Mayo Clinic study examined medical records collected as part of the Rochester Epidemiology Project. Using information collected by the project, researchers can identify what causes diseases; how diseases may progress over time; and how patients with certain conditions respond to surgery, medication or other interventions. Drs. Bancos and Ebbehøj and team used this resource to look at the prevalence of adrenal tumors in one area (Olmsted County, Minnesota) from the beginning of 1995 through 2017.

Figure 5. Irina Bancos, M.D. Dr. Bancos is a Mayo Clinic endocrinologist with a deep research interest in adrenal tumors and finding the best treatments for her patients. You can read her response to the question "What is adrenal insufficiency?" on the Mayo Clinic News Network.

Figure 6. Andreas L. Ebbehøj, M.D. Credit: Ida Marie Jensen, Aarhus University. "In this particular case, the question of how common the dangerous adrenal subtypes are out of all the adrenal incidentalomas is key," says Dr. Ebbehøj, who is pursuing a doctoral degree at Aarhus University in Denmark.

2022 GRADUATING CLINICAL ENDOCRINOLOGY FELLOWS

Arvind Maheshwari, M.B.B.S., Midwest Endocrinology, Crystal Lake, Illinois, Andres F. Henriquez, M.D., Endocrinology, Pembroke Pines, Florida, Catherine D. Zhang, M.D., Division of Endocrinology and Molecular Medicine, Medical College of Wisconsin, Milwaukee, Wisconsin.

Not pictured: Jennifer E. Clark, M.D., Peace Health Medical Group, Bellingham, Washington

2022 TEACHER OF THE YEAR

Jad G. Sfeir, M.D., M.S. Selected as 2022 Teacher of the Year in Endocrinology

Front: Leili Rahimi, M.D., Catherine D. Zhang, M.D., Kharisa N. Rachmasari, M.D., Rashi Sandooja, M.B.B.S., Prerna Dogra, M.B.B.S., Kara J. Zelinske (Program Coordinator), M. Regina Castro, M.D. (Program Director)
Back: Jad G. Sfeir, M.D.,M.S., Arvind Maheshwari, M.B.B.S., Andres F. Henriquez, M.D., Maheswaran Dhanasekaran, M.B.B.S., Andrew Welch, D.O., David Toro Tobon, M.D.

Education Opportunities

For more information or to register, visit *https://ce.mayo.edu/endocrinology*, call 800-323-2688 or email *cme@mayo.edu*.

PRINCIPLES IN THE CARE OF TRANSGENDER AND INTERSEX PATIENTS 2022

Oct. 13-15, 2022
Phoenix and Livestream
Mayo Clinic's Transgender and Intersex Specialty Care Clinic experts offer practical, evidence-based principles for providing care to transgender and intersex individuals and address medical, surgical, psychosocial, legal and ethical issues.

22ND ANNUAL NUTRITION AND WELLNESS IN HEALTH AND DISEASE 2022

Oct. 16-18, 2022
Coronado, Calif., and Livestream
Focus includes data gathering to address the needs of patients with obesity and associated medical conditions, plus the benefits of quality nutrition on overall health, aging and cardiovascular health.

3RD ANNUAL MAYO CLINIC THYROID AND PARATHYROID DISORDERS COURSE 2022

Nov. 10-12, 2022
Orlando, Fla., and Livestream
Topics include assessment of benign thyroid diseases, management of thyroid cancer and parathyroid disorders, and imaging modalities and diagnostic methods including molecular testing for evaluation of thyroid nodules.

Contact Us

Mayo Clinic welcomes inquiries and referrals, and a request to a specific physician is not required to refer a patient.

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Jacksonville, Florida
800-634-1417

Rochester, Minnesota
800-533-1564

Resources

MayoClinic.org/medicalprofessionals

Clinical trials, CME, Grand Rounds, scientific videos and online referrals

Endocrinology Update

Mayo Clinic Endocrinology Update is written for physicians and should be relied upon for medical education purposes only. It does not provide a complete overview of the topics covered and should not replace the independent judgment of a physician about the appropriateness or risks of a procedure for a given patient.

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