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## Radiofrequency Ablation Therapy for Large Benign Thyroid Nodules

Most thyroid nodules are benign and do not need intervention. However, some thyroid nodules are associated with progressive growth and may result in compressive symptoms and cosmetic concerns that might require intervention — typically thyroid surgery. Radiofrequency ablation (RFA) is a percutaneous treatment that results in thermal tissue necrosis and fibrosis. As a result of this process, the nodules shrink (Figure). Clinical trials in Italy and South Korea demonstrated a 50 to 80 percent durable nodule shrinkage after thyroid nodule RFA.

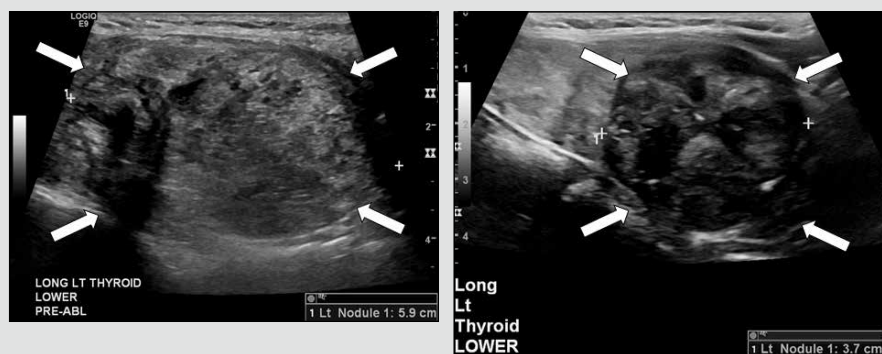
Marius N. Stan, M.D., with Endocrinology, Diabetes, Metabolism, and Nutrition at Mayo Clinic's campus in Rochester, Minnesota, says, "RFA for the management of benign thyroid nodules was first used at Mayo Clinic's Rochester campus in December 2013. RFA has been offered to patients with large ( $\geq 3$  cm), predominantly solid thyroid nodules that demonstrated growth or were causing compressive symptoms and cos-

metic concerns. Ultrasound-guided fine-needle aspiration biopsy was performed prior to RFA to document the benign nature of the nodule. In a publication in the *Mayo Clinic Proceedings* in 2018, we summarized our experience between December 2013 and October 2016, with 14 patients who underwent thyroid nodule RFA. Multiple nodules were present in 13 of the 14 patients, and the dominant and growing thyroid nodule was the one treated."

Robert A. Lee, M.D., with Radiology at Mayo Clinic in Rochester, Minnesota, explains: "For pain control and to prevent movement, RFA was completed under general anesthesia. To minimize the risk of complications, the outer approximate 5 mm of the nodule was not treated and the active tip of the electrode was kept at a safe distance to prevent a skin burn. Post-RFA the patients were observed for three hours and released home. The median age of the 14 patients was 60 years.

"The targeted thyroid nodules had a median volume of 24.2 mL prior to RFA. Prior to RFA, the nodules in 10 of the 14 patients had a median increase in size of 114 percent over a median of 51 months. Twelve nodules (85.7 percent) were causing compressive symptoms, and eight nodules (57.1 percent) were causing cosmetic concerns."

Matthew R. Callstrom, M.D., Ph.D., with Radiology at Mayo Clinic in Rochester, Minnesota, sums up the results: "After RFA the median thyroid nodule volume reduction was 44.6 percent over a median follow-up of 8.6 months (Figure). Of the 14 patients, 13 had normal thyroid function prior to RFA (two were taking levothyroxine replacement) and one had thyrotoxicosis. Thyroid function test results did not change during follow-up in the euthyroid patients and normalized in the patient who had a toxic nodule. Compressive



**Figure.** Left panel. Thyroid ultrasound showing a 5.9-cm thyroid nodule prior to radiofrequency ablation (RFA). Right panel. Thyroid ultrasound image obtained one year and eight months after thyroid nodule RFA showing the residual nodule to now measure 3.7 cm in maximum diameter.



Robert A. Lee, M.D., Marius N. Stan, M.D., John C. Morris III, M.D., Oksana Hamidi, D.O., and Matthew R. Callstrom, M.D., Ph.D.

symptoms (pressure in the neck or dysphagia) resolved in eight of 12 patients and improved in the other four patients. Cosmetic concerns improved in all eight patients.”

Dr. Stan continues, “Thyroid nodule RFA was well-tolerated in all of the patients. One patient developed hypotension after the procedure, which was attributed to a vasovagal response due to the deep, posterior location of the nodule in proximity to the vagal nerve. The patient was monitored overnight and dismissed the following day without any residual hemodynamic changes. Three patients (21 percent) developed mild neck discomfort, swelling, bruising and dysphagia shortly after RFA. These symptoms completely resolved within two to five days of the procedure. During follow-up, all patients expressed overall satisfaction with the decision to undergo the thyroid nodule RFA.”

## Weight Regain After Bariatric Surgery

Obesity is a life-limiting disorder associated with a number of comorbidities. Currently more than two-thirds of Americans are overweight (BMI  $\geq 25$  kg/m<sup>2</sup>) and over one-third are obese (BMI  $\geq 30$  kg/m<sup>2</sup>). Worldwide, 500 million adults are obese, and this number is estimated to increase to 1.12 billion by 2030.

Manpreet S. Mundi, M.D., with Endocrinology, Diabetes, Metabolism, and Nutrition at Mayo Clinic’s campus in Rochester, Minnesota, says, “Although there are many ways to lose weight in the short term, less than 20 percent of individuals who try to lose weight are able to achieve and maintain a 10 percent reduction over a year, with the majority gaining it back within three to five years.

John C. Morris III, M.D., with Endocrinology, Diabetes, Metabolism, and Nutrition at Mayo Clinic in Rochester, Minnesota, adds, “From an economic perspective, the cost of thyroid nodule RFA at our institution is approximately 30 to 50 percent that of a lobectomy. We recognize that our study cohort is small. Additional data are needed to fully assess the utility of RFA in the U.S. population, as most published studies come from a handful of expert centers, mainly in Italy and South Korea. To our knowledge, this is the first study to test the effectiveness and feasibility of thyroid nodule RFA in the United States.”

Dr. Stan concludes, “Our experience confirms that ultrasound-guided thyroid nodule RFA is an effective and safe outpatient treatment in patients with symptomatic or steadily growing benign, large, predominantly solid thyroid nodules. This procedure induces substantial thyroid nodule volume reduction, alleviates compressive symptoms and improves esthetic appearance, while preserving normal thyroid function.

“In centers with appropriate expertise, this technique could become an alternative for the management of benign large toxic and nontoxic thyroid nodules. Additional studies should be conducted in similar populations with a particular focus on factors predicting greater response to RFA and comparing the performance of RFA with other procedures.”

### For more information

Hamidi O, et al. Outcomes of radiofrequency ablation therapy for large benign thyroid nodules: A Mayo Clinic case series. *Mayo Clinic Proceedings*. In press.

“With regain of weight, individuals experience relapse of weight-related medical comorbidities, thus contributing once more to socio-economic and direct health care costs. This cycle of weight loss and regain is frustrating to individuals, and despite our understanding of the biological and behavioral defenses mounted by the body to maintain weight, there still exists a pragmatic gap for individuals who are directly affected.”

Weight-loss (bariatric) surgery is currently the most effective way to lose weight and has the highest rates of weight maintenance in the long term. The Swedish Obese Subjects study was an early reporter of bariatric surgery leading to sustainable weight loss and decreased





Front, left to right: Travis J. McKenzie, M.D., Andres J. Acosta, M.D., Ph.D., Meera Shah, M.B., Ch.B., Karen Grothe, Ph.D., L.P., Manpreet S. Mundi, M.D., Barham K. Abu Dayyeh, M.D., M.P.H., Maria L. Collazo-Clavell, M.D., Todd A. Kellogg, M.D. Back, left to right: Rhiannon M. Kisch, R.N., C.M.S.R.N., Ellen C. Bissonette, R.N., Ekta Kapoor, M.B.B.S., Matthew M. Clark, Ph.D., L.P., Julia A. Jurgensen, APRN, C.N.P., Mark A. Romportl, APRN, C.N.P., D.N.P., and Stephanie N. Vanderboom, APRN, C.N.P.

overall mortality when compared with lifestyle intervention alone. Results of the study were published in *The New England Journal of Medicine* in 2007.

The Roux-en-Y gastric bypass (RYGB) is considered the gold standard for weight-loss surgeries, but, unfortunately, it is not without the possibility of weight regain. In a recent prospective, long-term study of patients who had undergone RYGB, 93 percent of patients maintained at least a 10 percent weight loss from base line, 70 percent maintained at least a 20 percent weight loss and only 40 percent maintained at least a 30 percent weight loss after 12 years.

Meera Shah, M.B., Ch.B., with Endocrinology, Diabetes, Metabolism, and Nutrition at Mayo Clinic in Rochester, Minnesota, notes, “Patients who regain weight after bariatric surgery feel that they have failed their last option, leading to a great deal of frustration, anger and even depression. As we learn more about weight regain after bariatric surgery, we are finding that this is not the case — there are a number of reversible causes of weight regain in this population. Options such as behavior intervention, medications approved for weight loss and endoscopic interventions serve to counter some of the factors that have resulted in weight regain.”

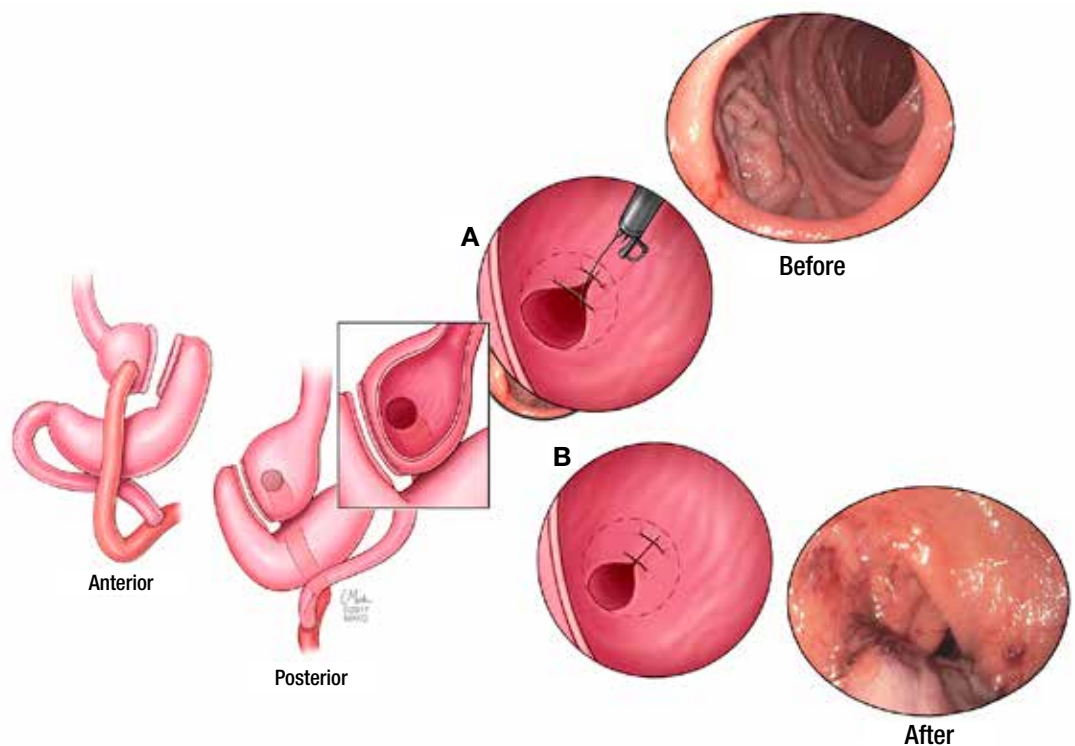
### Behavioral intervention

Karen Grothe, Ph.D., L.P., with Psychiatry and Psychology at Mayo Clinic in Rochester, Minnesota, explains, “Behavioral intervention for weight regain after bariatric surgery is based on the large nonsurgical lifestyle intervention literature.

Emerging studies focus specifically on intervention for patients experiencing post-surgical regain, addressing psychological and behavioral factors that can contribute to such regain.

“In the multisite Longitudinal Assessment of Bariatric Surgery 2 (LABS-2) study, participants who continued graze eating, who ate beyond feeling full, and who did not engage in self-weighting before or after surgery lost significantly less weight at three years post-surgery compared with participants who made those healthy behavior changes (24.6 percent vs. 38.8 percent weight loss). Lack of physical activity, uncontrolled psychological disorders and life stressors have also been suggested as factors related to regain. Behavioral drift — the slow movement away from a behavior or skill — is common for any skill that receives less attention over time, such as speaking a second language or playing a sport. It is also common among patients experiencing post-surgical weight regain.

“Studies have examined the application of traditional behavioral weight management programs for patients with weight regain after bariatric surgery to programs specifically tailored to the post-bariatric surgery population. Many patients struggling with regain are lost to follow-up; therefore, a foundational component to such specialized programs should be an open, nonjudgmental approach that begins with the acknowledgement that weight regain can occur. From that starting point, it can be helpful to offer behavioral intervention specific to this subgroup, such as the Back on Track group program we developed from a research study examining behavior therapy to stop regain.



**Figure.** Anatomic relationships of Roux-en-Y gastric bypass is shown on the left. A and B. The transoral outlet reduction (TORe) endoscopy procedure. An endoscopic suturing system is used to plicate the gastrojejunal anastomosis (Before) and reduce its size to 1 cm (After), thus restoring the restrictive component of the gastric bypass.

“Back on Track is a 12-week program offered throughout the year for any patient experiencing clinically significant weight regain (10 percent or more of weight lost). It includes curricula on nonjudgmental reflection on factors that played a role in regain, reducing behavioral drift, education about emerging weight-loss medications or post-surgical endoscopic procedures, emotion regulation strategies, and self-monitoring techniques. Others are also examining the inclusion of acceptance-based strategies and different modes of intervention delivery, such as online and by phone, in hopes of augmenting outcomes and reaching more patients.”

### Medications

Dr. Mundi reflects, “After removal of sibutramine from the market, the lipase inhibitor orlistat was the only FDA-approved weight-loss medication available for long-term use. However, since 2012, there have been four other medications approved for the primary indication of weight loss: lorcaserin hydrochloride, phentermine-topiramate, bupropion hydrochloride-naltrexone hydrochloride, and liraglutide. These medications are centrally acting appetite suppressants with the exception of liraglutide, which also has peripheral actions in the gastrointestinal tract and inhibits gastric emptying. In the nonbariatric surgery population, when compared with placebo and in conjunction with a comprehensive lifestyle

modification program, these medications provide modest additional total body weight loss (in the 4-10 percent range).”

Dr. Shah continues, “Although large randomized prospective trials are lacking, many smaller short-term trials and retrospective analyses are revealing good efficacy with the use of medications for weight regain after surgery. When choosing among these appetite suppressants in the appropriate patient, care should be given to medication interaction as well as the side effect profile of the medication. These medications have all been approved for chronic use, although given the relatively short time they have been on the market, there is limited clinical experience with efficacy and safety in the long term.”

### Endoscopic approach

Barham K. Abu Dayyeh, M.D., M.P.H., a gastroenterologist who specializes in bariatric and metabolic endoscopy at Mayo Clinic in Rochester, Minnesota, says, “One of the most common anatomical changes over time is the enlargement of gastrojejunal stoma size, contributing to weight regain by a reduction in satiety and allowing the patient to increase volume of food consumed in one meal. Dilated gastrojejunal stoma can be treated surgically; however, this revision requires a technically difficult dissection and has a significant risk of morbidity and complications.

“Recently, with advancements in endoscopic

suturing devices, a novel approach to reduction of the stoma diameter has emerged: transoral outlet reduction (TORe) endoscopy (Figure). This procedure can be performed on an outpatient basis with a favorable risk profile compared with revisional bariatric surgery. An endoscopic suturing system is used to plicate the gastrojejunal anastomosis and reduce its size to 1 cm, thus restoring the restrictive component of the gastric bypass.

“A number of studies have shown efficacy in patients who are regaining weight. In a study published in *Surgical Endoscopy* in 2018, in 130 consecutive patients across three centers undergoing TORe with an endolumenal suturing device, the average weight lost at six, 12 and 18 months after TORe was  $9.31 \pm 6.7$  kg ( $n = 84$ ),  $7.75 \pm 8.4$  kg ( $n = 70$ ) and  $8 \pm 8.8$  kg ( $n = 46$ ), respectively.”

Weight regain after bariatric surgery can be devastating to patients, as they often feel like failures and are at a loss for where to go next. There are now a number of options available to them, including cognitive behavioral therapy programs tailored to their needs, weight-loss medications, and endoscopic approaches such as TORe.

#### For more information

Sjöström L, et al. Effects of bariatric surgery on mortality in Swedish obese subjects. *The New England Journal of Medicine*. 2007;357:741.

Vargas EJ, et al. Transoral outlet reduction with full thickness endoscopic suturing for weight regain after gastric bypass: A large multicenter international experience and meta-analysis. *Surgical Endoscopy*. 2018;32:252.

## Dr. George D. Molnar and Glycemic Variability

Dr. George D. Molnar resigned his Mayo Clinic staff appointment in the Division of Endocrinology in 1975 to accept the chairmanship of medicine at his alma mater, the University of Alberta Medical School in Edmonton, Alberta. During his 23 years at Mayo Clinic he created a scientific legacy that spawned fruitful contributions by others after his departure.

Molnar was born July 20, 1922, in Szekesfehervar, Hungary, to a Presbyterian minister

father and a Berlitz instructor mother who spoke to him over 12-month periods solely in one language at a time among German, French, English and Italian. Concerns about the impending war prompted immigration to Canada in the 1930s. After a brief period of time in Hamilton, Ontario, Molnar moved to Calgary, Alberta, with his father, who was assigned to a church there.

At age 19, Molnar joined the Canadian army and rose quickly through the ranks to become the youngest to achieve the rank of captain. His linguistic skills were put to good use in the intelligence corps, especially when acting as the interpreter for the surrender of Nazi generals in Holland on May 5, 1945.

After demobilization Molnar went on to university and graduated in 1951 with B.S. and M.D. degrees while winning all of the school's top awards and medals. After an internship at the University of Alberta Hospital, he entered the Mayo Graduate School of Medicine in 1952 and garnered a Ph.D. from the University of Minnesota in 1956. He was appointed to the Mayo Clinic staff in 1955 and rose to the rank of professor of medicine in 1971.

F. John Service, M.D., Ph.D., emeritus staff with Endocrinology, Diabetes, Metabolism, and Nutrition at Mayo Clinic in Rochester, Minnesota, and on staff from 1969-2001, trained under Dr. Molnar. Dr. Service explains, “Dr. Molnar's interest in diabetes was directed at brittle diabetes, which was a term used to describe the most severe form of what today would be designated



Dr. George D. Molnar in photograph taken in 1965. Dr. Molnar was on staff at Mayo Clinic from 1952-1975.



F. John Service, M.D., Ph.D. (left), Dr. George D. Molnar (center) and a patient volunteer participating in the new automated blood glucose determination system. Photograph from September 1967.



as type 1 diabetes. The state of knowledge of the etiology of the various clinical manifestations of diabetes was primitive to nonexistent.

“Two general groups were identified: stable and unstable diabetes. Speculation as to the cause of unstable diabetes ranged widely from disordered metabolism of various factors, both circulating and static, psychoneuroendocrine dysfunction, and consideration that brittleness was an acquired phenomenon. Brittle diabetes was characterized by unpredictable swings in blood glucose from marked hyperglycemia to severe hypoglycemia.

“The ability to document glycemic events at that period of time was limited to occasional and sporadic venipunctures and quantitative urine glucose analysis. Direct measurement of blood glucose in a continuous fashion during ordinary life activities was desperately needed. Dr. Molnar teamed up with Dr. John Rosevear with Laboratory Medicine at Mayo Clinic in Rochester, Minnesota, to develop such a methodology for continuous blood glucose analysis.”

Studies conducted in volunteers with unstable (type 1) diabetes and stable (type 2) diabetes and volunteers who did not have diabetes confirmed the marked variability in glycemia in the former and the exquisite homeostasis in the latter. Dr. Molnar’s team generated a mathematical expression for glycemic variability known as mean amplitude of glycemic excursion, which

has stood the test of time and is recognized as the gold standard.

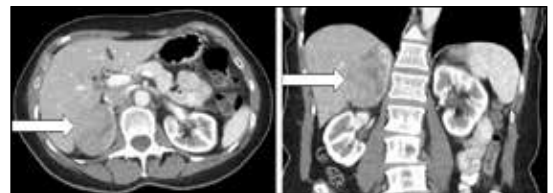
With the recent development of the radioimmunoassay (RIA) technique by Drs. Solomon A. Berson and Rosalyn Yalow, Dr. Molnar applied the RIA to the measurement of insulin during the continuous monitoring studies that demonstrated an inverse relationship between blood glucose and serum insulin in unstable diabetes contrasted to a direct relationship for stable diabetes and nondiabetes. The longstanding uncertainty about the primary defect in unstable diabetes evaporated with this observation and was confirmed once C-peptide was shown to be absent in these patients.

Dr. Service concludes: “These observations formed the underpinning for the development of the modern therapy for type 1 diabetes and consequently opened the door for clinical trials designed to examine the potential for benefit of tight glucose control.” Following Dr. Molnar’s departure, physicians at Mayo Clinic successfully competed for a National Institutes of Health contract to develop a device for the improved management of diabetes in 1978. They participated in the Kroc multicenter clinical trial in 1980, the Diabetes Control and Complications Trial in 1982 and its follow-up, the Epidemiology of Diabetes Interventions on Complications in 1993 to the present.”

## Adrenocortical Cancer Presenting as Postmenopausal Bleeding: A Case From the Endocrine Teaching Clinics

Lynch syndrome (LS) is a hereditary cancer predisposition syndrome caused by inactivating mutations in DNA mismatch repair (MMR) genes. Germline mutations in the MSH6 MMR gene account for approximately 18 percent of LS cases.

A 65-year-old woman with a past medical history of hypertension was diagnosed with LS due to an MSH6 germline mutation as part of family testing. (Her sister, who had a history of colon and endometrial cancers, was the LS proband in the family). The woman was evaluated with a colonoscopy, which was normal. Transvaginal ultrasound was performed to evaluate uterine bleeding; it showed a retroverted uterus with endometrial thickening and uterine fibroids. The ultrasound study detected a heterogeneous echogenic mass within the right upper quadrant of the abdomen. The patient subsequently



**Figure 1.** Axial CT image (left panel) and coronal CT image (right panel) showing a 6.0-by-5.1-by-7.8-cm right adrenal mass (arrows).

underwent dilation and curettage of endometrial hyperplasia and pathology was benign. An abdominal CT scan showed a heterogeneous right adrenal mass, 6.0-by-5.1-by-7.8 cm (Figure 1). The woman was referred to Mayo Clinic for further evaluation of the right adrenal mass.

The patient had noted symptoms of fatigue, loss of appetite and a 3-pound weight loss over the prior two weeks. There was no history of

any signs or symptoms of adrenal hormone excess. On physical examination she did not have cushingoid features, acne or hirsutism. However, biochemical testing demonstrated androgen, estrogen and corticotropin-independent cortisol excess (Table).

Based on the clinical, biochemical and imaging presentation, adrenal cortical carcinoma (ACC) was suspected and an open right adrenalectomy was performed. Final pathology demonstrated a 9.2-by-5.9-by-4.8-cm adrenal oncocytic ACC (Figure 2) with focal extracapsular extension into periadrenal adipose tissue, Ki-67 index of 15 percent and a peak mitotic count of 40 mitoses in 50 high-powered fields.

Postoperatively, the patient was treated with glucocorticoid replacement therapy; treatment with mitotane was started six weeks postoperatively. During the subsequent 18 months of follow-up, the patient remains in remission as demonstrated by negative imaging and normalization of steroid precursors.



Irina Bancos, M.D., and Nana Esi N. Kittah, M.B., Ch.B.



**Figure 2.** Gross pathology serial cut sections of a 9.2-cm right adrenocortical carcinoma.

### Discussion

ACC occurs in up to 5 percent of patients with adrenal tumors. ACC occurs most frequently in the fifth to sixth decade of life and demonstrates a female to male predominance of 2.5-to-1. Although most ACCs are sporadic, they can also occur as a part of syndromes such as Li-Fraumeni syndrome, Beckwith-Wiedemann syndrome, multiple endocrine neoplasia, type 1, familial adenomatous polyposis, neurofibromatosis 1, and LS.

In a study published in the *Journal of Clinical Oncology* in 2013, the prevalence of LS in patients with ACC was 3.2 percent and higher than in the general population (0.2 percent) and comparable to the prevalence of LS in patients with colorectal cancer (2-4 percent) and endometrial cancer (1-5 percent). The patient described herein had no other manifestations of LS.

ACCs are typically large tumors with a median size greater than 10 cm. The diagnosis of ACC is based on clinical presentation and imaging characteristics of adrenal mass, but remains challenging due to suboptimal accuracy of

Laboratory Test	Before Surgery	1 Month After Surgery	Reference Range
<b>24-hr urine</b>			
Dopamine, mcg/24 hours	187	N/A	65-400
Epinephrine, mcg/24 hours	2.9	N/A	< 21
Norepinephrine, mcg/24 hours	56	N/A	15-80
Metanephrines, mcg/24 hours	68	N/A	< 400
Normetanephrines, mcg/24 hours	340	N/A	< 900
Total metanephrines, mcg/24 hours	408	N/A	< 1300
Urine free cortisol, mcg/24 hours	68	N/A	3.5-45
<b>Serum</b>			
ACTH, pg/mL	< 5	N/A	7.2-63
8 a.m. serum cortisol following 1-mg overnight dexamethasone suppression test, mcg/dL	13	N/A	< 1.8
Aldosterone concentration, ng/dL	20	N/A	≤ 21
Renin plasma activity, ng/mL/hr	2	N/A	0.6-3.0
Androstenedione, ng/dL	151	N/A	30-200
DHEA sulfate, mcg/dL	403	< 15	< 15-157
17-hydroxyprogesterone, ng/dL	167	< 40	< 51
17-hydroxypregnenolone, ng/dL	888	< 16	31-455
Testosterone, ng/dL	30	< 7	8-60
Estradiol, pg/mL	113	< 10	< 10 (postmenopausal)

**Table.** Results of biochemical testing demonstrate androgen, estrogen and corticotropin-independent cortisol excess.

available tests. As outlined in an article published in *Current Opinion in Endocrinology, Diabetes and Obesity* in 2017, urine steroid metabolomics is a promising tool to diagnose ACC and is currently under validation. It is important to note

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## 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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## Resources

**MayoClinic.org/medicalprofs**

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



that when ACC is suspected, the clinician should avoid biopsy and proceed with adrenalectomy.

Surgical resection is the mainstay of treatment for ACC with a goal to achieve a R0 resection. Further management depends on the stage of ACC and prognostic markers derived from pathology examination. In the patient under discussion who presented with ACC associated with extracapsular extension and a Ki-67 of 15 percent and underwent a R0 resection, mitotane therapy was recommended and initiated. The patient was monitored at every three-month clinical visit for evaluation of mitotane efficacy and

side effects, and with cross-sectional imaging for the first year with a plan to decrease the frequency of follow-up visits in the second year.

### For more information

Raymond VM, et al. Adrenocortical carcinoma is a Lynch syndrome-associated cancer. *Journal of Clinical Oncology*. 2013;31:3012.

Bancos I, et al. Diagnosis of a malignant adrenal mass: The role of urinary steroid metabolite profiling. *Current Opinion in Endocrinology, Diabetes and Obesity*. 2017;24:200.

## Education Opportunities

### 18th Annual Nutrition and Wellness in Health and Disease 2018

Sept. 27-28, 2018, at Marriott San Antonio Riverwalk, San Antonio

This course is designed for physicians, advanced practice clinicians, dietitians, nurses, and health and wellness staff. Many physicians and other clinicians have had limited training in nutrition, yet nutrition is key to the management of many endocrine disorders, such as diabetes, obesity and lipid disorders. In addition, physical activity and other healthy lifestyle behaviors are vital components in the promotion of health and the treatment of disease. Physicians, bariatric surgeons, psychologists, dietitians, and health and wellness specialists will discuss situations commonly encountered in the ambulatory setting. Topics include obesity in adults and children, individual and group-based weight management strategies, and dietary, behavioral change, activity, pharmacological and bariatric approaches. Additional topics will include nutrition and physical activity management of common obesity-associated conditions plus physical activity and wellness topics for attendees and their patients. Presentations offer practical clinical management pearls, interactive case studies and panel discussions. For more information, visit <https://ce.mayo.edu/internal-medicine/content/18th-annual-nutrition-and-wellness-health-and-disease-2018> or call 800-323-2688 (toll-free). Course hashtag: #MayoNutrCME.

### 21st Annual Endocrine Update 2019

Feb. 11-15, 2019, at Fairmont Orchid, Kohala Coast, Big Island, Hawaii

Designed for endocrinologists and interested internists and surgeons, this Endocrine Update addresses gaps in medical knowledge and barriers in clinical practice to improve the outcomes of patients with endocrine and metabolic disorders. Topics span the full range of endocrinology through lectures, debates, panel discussions, clinicopathologic sessions, clinical pearls sessions, informal breakfast roundtable discussions and small-group discussions with experts. Attendees have plenty of opportunity for interaction with course faculty selected for their expertise and clinical acumen. For more information, visit <https://ce.mayo.edu/internal-medicine/content/21st-annual-endocrine-update-2019> or call 800-323-2688 (toll-free).

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4500 San Pablo Road  
Jacksonville, FL 32224

200 First Street SW  
Rochester, MN 55905

13400 East Shea Boulevard  
Scottsdale, AZ 85259

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