MAYO CLINIC LABORATORIES

Test Definition: ACC

Adrenal Mass Panel, 24 Hour, Urine

Overview

Useful For

Aiding in assessing malignancy in adrenal masses

May aid in improving diagnostic and prognostic prediction and dissect disease mechanisms for the following applications:
-Diagnostic assessment and follow up of adrenal cortical carcinoma
-Differential diagnostic assessment of adrenal tumors
-Additional assessment related to Cushing syndrome, mild autonomous cortisol secretion, primary aldosteronism, inborn errors of steroidogenesis, polycystic ovary syndrome

This test is **not useful for** establishing eligibility for a specific treatment as results must be interpreted in conjunction with the clinical status of the patient.

Testing Algorithm

Testing begins with a clinical risk assessment based on clinical data before integration with biochemical steroid data to assess the probability of a malignant adrenal cortical carcinoma (ACC) or other malignancy (sarcoma, lymphoma, other) as well as the probability of a benign mass (adenoma, myelolipoma, cyst, other).

Clinical data includes age at diagnosis, gender, mode of discovery and hormonal status along with tumor diameter and an unenhanced computerized tomography (CT) scan density measurement of the tumor (in Hounsfield units).

Steroids and their metabolites are extracted, analyzed, quantitated, and reported. Each reported analyte also includes a Z-score. An integrated risk assessment based on clinical data in combination with biochemical steroid data is reported to assess the probability of a malignant ACC or other malignancy as well as the probability of a benign mass.

For more information see Adrenal Mass Panel Clinical Data Definition of Malignancy Predictors.

Special Instructions

- Urine Preservatives-Collection and Transportation for 24-Hour Urine Specimens
- Adrenal Mass Panel Clinical Data Definition of Malignancy Predictors
- Adrenal Mass Panel Patient Information

Highlights

This test offers an accurate, rapid, cost-effective, noninvasive tool to better assess malignant adrenal tumors and assist clinicians in determining whether an adrenal mass is benign or malignant.

Method Name

Liquid Chromatography Mass Spectrometry, High-Resolution Accurate Mass (LC-MS HRAM)

NY State Available

Yes

Specimen

Specimen Type
Urine

Shipping Instructions
Ship specimens frozen.

Necessary Information
The following information is required. Testing cannot proceed without this information (NA or Not Applicable are not acceptable responses).
-Age at diagnosis (Years, not offered for pediatric patients)
-Gender (Male, Female)
-Mode of discovery (incidental, cancer staging, other)
-Tumor diameter (mm)
-Unenhanced computerized tomography (CT) (Hounsfield units)
-Hormonal excess (Yes = Present, No=Absent)
-Collection duration in hours and 24-hour volume in milliliters

If information is not provided within 5 days of specimen receipt at MCL, testing may be delayed or canceled.

If not ordering electronically, Adrenal Mass Panel Patient Information is required.

Specimen Required
Supplies: Sarstedt Aliquot Tube, 5 mL (T914)
Container/Tube: Plastic urine tube
Specimen Volume: 4 mL
Collection Instructions:
1. Collect urine for a full 24 hours (required) and record the total volume.
2. Do not add preservatives. **Specimens containing preservatives will be canceled.**
3. Entire 24 hour collection must be mixed well prior to aliquoting into a 5 mL plastic tube.
Additional Information: See Urine Preservatives-Collection and Transportation for 24-Hour Urine Specimens for multiple collections.

Forms
Adrenal Mass Panel Patient Information **is required** if not ordering electronically.

Urine Preservative Collection Options
Note: The application of temperature controls **must occur within 4 hours of completion** of the collection.

Ambient (no additive)	No
Refrigerate (no additive)	OK
Frozen (no additive)	OK

50% Acetic Acid	No
Boric Acid	No
Diazolidinyl Urea	No
6M Hydrochloric Acid	No
6M Nitric Acid	No
Sodium Carbonate	No
Toluene	No

Specimen Minimum Volume

2 mL

Reject Due To

Gross hemolysis	OK
Gross icterus	OK

Specimen Stability Information

Specimen Type	Temperature	Time	Special Container
Urine	Frozen (preferred)	90 days	
	Refrigerated	14 days	

Clinical & Interpretive

Clinical Information

Approximately 80 million computerized tomography (CT) scans are performed in the United States every year. Adrenal tumors are found incidentally in about 5% of patients undergoing abdominal CT. Most of these tumors will be benign, but a small fraction are adrenal cortical carcinomas (ACC), a cancer with high mortality and frequent recurrence. Even for localized disease, the 5-year survival rates do not exceed 65%, while distant spread is associated with a greater than 90% mortality rate. Early diagnosis of a malignant adrenal mass is therefore imperative to assure timely and appropriate therapy.

Unfortunately, CT imaging alone is very limited in its ability to distinguish benign from malignant adrenal tumors since only very small and hypodense lesions can be easily dismissed as benign. The sizeable group of patients with larger or denser tumors ends up with an arduous workup that frequently includes additional imaging studies, hormonal testing, and biopsy. However, even the latter has both a high diagnostic false-positive and false-negative rate, and ultimately the tumor is often resected, sometimes unnecessarily. On the other hand, the delays due to the diagnostic work might compromise optimal care for those tumors that prove malignant.

In addition, patients who are believed to probably not have adrenal cancer after their workup, and those who opt out of surgery, often still require long-term follow up with regular re-imaging and repeated hormone testing, with resultant radiation exposure and high healthcare costs.

This adrenal mass panel is a noninvasive and more accurate test to diagnose malignant adrenal tumors, via urinary steroid profiling. It differentiates ACC, a rare and lethal tumor, from benign adrenocortical adenomas (ACA), including those that overproduce corticosteroids, mineral steroids, sex steroids, or those that are hormonally inactive. The test utilizes both clinical and laboratory data. The clinical parameters are age at diagnosis and sex of the patient, the size of the tumor by CT scanning and its CT density in Hounsfield units, whether it was detected incidentally or not, and whether there is evidence of hormone overproduction. All of these data are readily available for almost all patients with an adrenal mass and are used by an algorithm to calculate the pretest probability of having ACC. The steroid profile testing is then performed, and the results are added into the risk calculation algorithm to generate an integrated probability. The final result will provide the referring physicians a highly accurate probability for ACC and will thereby facilitate the optimal choice of further investigation, if any, based on an informed discussion between doctor and patient. In addition, it allows, albeit with lesser accuracy, the detection of malignant adrenal tumors that are not ACCs.

Finally, standalone steroid profiles can be performed for the purpose of offering the diagnosis of complex assessment of steroidal disorders, disease monitoring of patients with ACC, and for novel investigations, such as biopharma studies.

Understanding the Adrenal Glands:
The human body has 2 adrenal glands, one above each kidney. Adrenal glands influence many processes and functions of the body, mainly through production of 3 types of steroid hormones:
-Mineralocorticoids (eg, aldosterone, which helps control blood pressure)
-Glucocorticoids (eg, cortisol, which is important for metabolism, immune response, and stress)
-Sex steroids (eg, DHEAS, a precursor of testosterone and estradiol)

These steroids are all synthesized from cholesterol via enzymes in the adrenal glands. In benign ACA, near-normal levels of precursor and bioactive steroids are produced. By contrast, ACC frequently shows abnormal patterns of steroid production. By measuring 25 different steroid metabolites, even subtle abnormalities can be detected. This is the basis for the assessment capability of profiling 25 steroids. In addition, catecholamines-the "flight or fight hormones"-are also synthesized in a different portion of the adrenal glands. This portion is not examined in the ACC panel.

Epidemiology of Adrenal Tumors:
Adrenal masses are found in 1% to 5% of the adult population. The prevalence increases with age, to around 10% at aged 70.

Although the majority of these tumors are benign, around 30% of adrenal tumors (>4 cm) are malignant (half are represented by ACC), and the survival rate for these patients is very poor unless detected early.

Reference Values

Note: Due to the wide range of urine steroid metabolite concentrations seen in healthy individuals and their skewed distribution, the reference values are based on the back calculated +/- 3SD of log transformed data.

Males 18-49 years:
Androsterone: 182-29,212 mcg/24 h
Etiocholanolone: 133-23,272 mcg/24 h
Dehydroepiandrosterone: <5-81,554 mcg/24 h
16a-OH-Dehydroepiandrosterone: 13-29,945 mcg/24 h

5-Pregnenetriol: 23-7,328 mcg/24 h
5-Pregnenediol: 13-2,823 mcg/24 h
Tetrahydro-11-Corticosterone: 8-1,961 mcg/24 h
Tetrahydro-11-Deoxycorticosterone: <5-316 mcg/24 h
Pregnanediol: 12-3,812 mcg/24 h
17a-OH-Pregnanolone: 15-2,466 mcg/24 h
Pregnanetriol: 66-9,409 mcg/24 h
Pregnanetriolone: <5-550 mcg/24 h
Tetrahydrodeoxycortisol: 7-1520 mcg/24 h
Cortisol: <5-903 mcg/24 h
6B-OH-Cortisol: 13-2,303 mcg/24 h
Tetrahydrocortisol: 152-22,723 mcg/24 h
5a-Tetrahydrocortisol: 157-24,059 mcg/24 h
B-Cortol: 30-5,115 mcg/24 h
11B-OH-Androsterone: 108-11,987 mcg/24 h
11B-OH-Etiocholanolone: 22-8,312 mcg/24 h
Cortisone: 12-842 mcg/24 h
Tetrahydrocortisone: 271-44,355 mcg/24 h
a-Cortolone: 140-14,885 mcg/24 h
B-Cortolone: 72-9,740 mcg/24 h
11-Oxoetiocholanolone: 70-8,446 mcg/24 h

Males > or =50 years:
Androsterone: 118-25,389 mcg/24 h
Etiocholanolone: 127-15,640 mcg/24 h
Dehydroepiandrosterone: 7-4,260 mcg/24 h
16a-OH-Dehydroepiandrosterone: 11-6,183 mcg/24 h
5-Pregnenetriol: 24-2,162 mcg/24 h
5-Pregnenediol: 17-1,296 mcg/24 h
Tetrahydro-11-Corticosterone: 16-1,674 mcg/24 h
Tetrahydro-11-Deoxycorticosterone: <5-297 mcg/24 h
Pregnanediol: 23-1,846 mcg/24 h
17a-OH-Pregnanolone: 18-1,747 mcg/24 h
Pregnanetriol: 115-5,432 mcg/24 h
Pregnanetriolone: 5-221 mcg/24 h
Tetrahydrodeoxycortisol: 12-1,277 mcg/24 h
Cortisol: 12-597 mcg/24 h
6B-OH-Cortisol: 22-2,406 mcg/24 h
Tetrahydrocortisol: 331-19,009 mcg/24 h
5a-Tetrahydrocortisol: 155-35,266 mcg/24 h
B-Cortol: 56-3,541 mcg/24 h
11B-OH-Androsterone: 142-13,135 mcg/24 h
11B-OH-Etiocholanolone: 69-6,805 mcg/24 h
Cortisone: 24-732 mcg/24 h
Tetrahydrocortisone: 454-34,576 mcg/24 h

a-Cortolone: 211-17,591 mcg/24 h
B-Cortolone: 114-8,434 mcg/24 h
11-Oxoetiocholanolone: 155-7,174 mcg/24 h

Females 18-49 years:
Androsterone: 90-29,625 mcg/24 h
Etiocholanolone: 127-24,568 mcg/24 h
Dehydroepiandrosterone: <5-12,317 mcg/24 h
16a-OH-Dehydroepiandrosterone: 5-31,248 mcg/24 h
5-Pregnenetriol: 17-4,166 mcg/24 h
5-Pregnenediol: 6-2,900 mcg/24 h
Tetrahydro-11-Corticosterone: 13-1,548 mcg/24 h
Tetrahydro-11-Deoxycorticosterone: <5-833 mcg/24 h
Pregnanediol: 8-44,760 mcg/24 h
17a-OH-Pregnanolone: 7-3,208 mcg/24 h
Pregnanetriol: 50-9,768 mcg/24 h
Pregnanetriolone: <5-139 mcg/24 h
Tetrahydrodeoxycortisol: 7-1,047 mcg/24 h
Cortisol: 11-642 mcg/24 h
6B-OH-Cortisol: 22-2,061 mcg/24 h
Tetrahydrocortisol: 185-16,515 mcg/24 h
5a-Tetrahydrocortisol: 45-22,591 mcg/24 h
B-Cortol: 28-4260 mcg/24 h
11B-OH-Androsterone: 59-12,462 mcg/24 h
11B-OH-Etiocholanolone: 32-6,354 mcg/24 h
Cortisone: 19-749 mcg/24 h
Tetrahydrocortisone: 262-32,461 mcg/24 h
a-Cortolone: 207-13,931 mcg/24 h
B-Cortolone: 63-7,489 mcg/24 h
11-Oxoetiocholanolone: 63-7,449 mcg/24 h

Females > or =50 years:
Androsterone: 32-10,134 mcg/24 h
Etiocholanolone: 52-10,946 mcg/24 h
Dehydroepiandrosterone: <5-10,046 mcg/24 h
16a-OH-Dehydroepiandrosterone: <5-9,982 mcg/24 h
5-Pregnenetriol: 10-1,901 mcg/24 h
5-Pregnenediol: <5-2,732 mcg/24 h
Tetrahydro-11-Corticosterone: 14-1,229 mcg/24 h
Tetrahydro-11-Deoxycorticosterone: <5-123 mcg/24 h
Pregnanediol: 8-2,138 mcg/24 h
17a-OH-Pregnanolone: <5-571 mcg/24 h
Pregnanetriol: 26-3,444 mcg/24 h
Pregnanetriolone: <5-348 mcg/24 h
Tetrahydrodeoxycortisol: 8-801 mcg/24 h

Cortisol: 9-336 mcg/24 h
6B-OH-Cortisol: 25-1,365 mcg/24 h
Tetrahydrocortisol: 237-14,050 mcg/24 h
5a-Tetrahydrocortisol: 92-12,604 mcg/24 h
B-Cortol: 29-3289 mcg/24 h
11B-OH-Androsterone: 86-9,280 mcg/24 h
11B-OH-Etiocholanolone: 40-7,002 mcg/24 h
Cortisone: 15-555 mcg/24 h
Tetrahydrocortisone: 359-24,320 mcg/24 h
a-Cortolone: 125-17,472 mcg/24 h
B-Cortolone: 82-5,784 mcg/24 h
11-Oxoetiocholanolone: 78-6,571 mcg/24 h

Reference values have not been established for patients who are younger than 18 years.

Interpretation

This test provides clinical risk values based on clinical data alone as well as integrated risk values based on clinical data in combination with biochemical steroid data. Reported risk values correspond to the probability of a malignant adrenal cortical carcinoma or other malignancy (eg, sarcoma, lymphoma) as well as the probability of a benign mass (eg, adenoma, myelolipoma, cyst).

Test results provide the referring physician with probabilities for a variety of outcomes, thereby aiding the interpretation of clinical status and optimal paths for further investigation, if any, based on an informed discussion between provider and patient. Test results should always be interpreted in conjunction with all other clinical findings as they cannot be interpreted as absolute evidence for the presence or absence of malignant disease.

For more information see Adrenal Mass Panel Clinical Data Definition of Malignancy Predictors.

Cautions

Test not offered for pediatric patients. Risk assessments are based on adult populations.

Test results cannot be interpreted as absolute evidence for the presence or absence of malignant disease. This test should not form the sole basis for a diagnosis or treatment decision as results must be interpreted within the clinical context of the patient and should always be used in conjunction with clinical findings.

This test may be difficult to interpret in pregnant women and in patients with severe impairment of liver or kidney function.

Risk assignments for other malignancy may not be as accurate as risk assignment for adrenal cortical carcinoma or adrenal cortical adenoma.

Clinical Reference

1. Arlt W, Biehl M, Taylor AE, et al. Urine steroid metabolomics as a biomarker tool for detecting malignancy in adrenal tumors. J Clin Endocrinol Metab. 2011;96(12):3775-3784. doi:10.1210/jc.2011-1565
2. Hines JM, Bancos I, Bancos C, et al. High-resolution, accurate-mass (HRAM) mass spectrometry urine steroid profiling in the diagnosis of adrenal disorders. Clin Chem. 2017;63(12):1824-1835. doi:10.1373/clinchem.2017.271106

3. Bancos I, Arlt W. Diagnosis of a malignant adrenal mass: the role of urinary steroid metabolite profiling. Curr Opin Endocrinol Diabetes Obes. 2017;24(3):200-207. doi:10.1097/MED.0000000000000333
4. Fassnacht M, Arlt W, Bancos I, et al. Management of adrenal incidentalomas: European Society of Endocrinology Clinical Practice Guideline in collaboration with the European Network for the Study of Adrenal Tumors. Eur J Endocrinol. 2016;175(2):G1-G34. doi:10.1530/EJE-16-0467

Performance

Method Description
As steroids and their metabolites may be excreted as glucuronide or sulfate conjugates, 24-hour patient urine is incubated with B-Glucuronidase to hydrolyze the conjugates. The steroid metabolites then undergo liquid-liquid extraction, resulting. in a purified mixture of unconjugated/neutral steroid analytes. This mixture is analyzed and quantitated by liquid chromatography high-resolution accurate mass-mass spectrometry.(Unpublished Mayo method)

PDF Report
No

Day(s) Performed
Tuesday

Report Available
7 to 24 days

Specimen Retention Time
14 months

Performing Laboratory Location
Mayo Clinic Laboratories - Rochester Superior Drive

Fees & Codes

Fees
- Authorized users can sign in to Test Prices for detailed fee information.
- Clients without access to Test Prices can contact Customer Service 24 hours a day, seven days a week.
- Prospective clients should contact their account representative. For assistance, contact Customer Service.

Test Classification
This test was developed and its performance characteristics determined by Mayo Clinic in a manner consistent with CLIA requirements. It has not been cleared or approved by the US Food and Drug Administration.

CPT Code Information
0015M

LOINC® Information

Test ID	Test Order Name	Order LOINC® Value
ACC	Adrenal Mass Panel, 24 Hr, U	95556-7

Result ID	Test Result Name	Result LOINC® Value
AC1AG	Age at Diagnosis	63932-8
AC2GD	Gender	76691-5
AC3MD	Mode of Discovery	95557-5
AC4TZ	Tumor Diameter (mm)	21889-1
AC5HX	Unenhanced CT (Hounsfield Units)	95558-3
AC6HM	Hormonal Excess	95559-1
TM66	Collection Duration (h)	13362-9
VL66	Volume (mL)	3167-4
607276	ACC - Clinical Risk	95787-8
607277	Other Malignancy - Clinical Risk	95788-6
607278	Benign Mass - Clinical Risk	95789-4
607279	ACC - Integrated Risk	95790-2
607280	Other Malignancy - Integrated Risk	95791-0
607281	Benign Mass - Integrated Risk	95792-8
607333	Comment	77202-0
607283	Androsterone	6705-8
607284	Androsterone Z-score	95560-9
607285	Etiocholanolone	2268-1
607286	Etiocholanolone Z-score	95561-7
607287	Dehydroepiandrosterone	13612-7
607288	Dehydroepiandrosterone Z-score	95562-5
607289	16a-OH-Dehydroepiandrosterone	95563-3
607290	16a-OH-DHEA Z-score	95564-1
607291	5-Pregnenetriol	95565-8
607292	5-Pregnenetriol Z-score	95566-6
607293	5-Pregnenediol	95567-4
607294	5-Pregnenediol Z-score	95568-2
607295	Tetrahydro-11-Corticosterone	95569-0
607296	TH-11-Corticosterone Z-score	95570-8
607297	Tetrahydro-11-Deoxycorticosterone	95571-6
607298	TH-11-Deoxycorticosterone Z-score	95572-4
607299	Pregnanediol	2834-0
607300	Pregnanediol Z-score	95573-2
607301	17a-OH-Pregnanolone	95574-0
607302	17a-OH-Pregnanolone Z-score	95575-7
607303	Pregnanetriol	2836-5
607304	Pregnanetriol Z-score	95576-5

607305	Pregnanetriolone	50643-6
607306	Pregnanetriolone Z-score	95577-3
607307	Tetrahydrodeoxycortisol	2996-7
607308	Tetrahydrodeoxycortisol Z-score	95578-1
607309	Cortisol	14158-0
607310	Cortisol Z-score	95579-9
607311	6B-OH-Cortisol	13611-9
607312	6B-OH-Cortisol Z-score	95580-7
607313	Tetrahydrocortisol	2995-9
607314	Tetrahydrocortisol Z-score	95581-5
607315	5a-Tetrahydrocortisol	21044-3
607316	5a-Tetrahydrocortisol Z-score	95582-3
607317	B-Cortol	53634-2
607318	B-Cortol Z-score	95583-1
607319	11B-OH-Androsterone	6701-7
607320	11B-OH-Androsterone Z-score	95584-9
607321	11B-OH-Etiocholanolone	6700-9
607322	11B-OH-Etiocholanolone Z-score	95585-6
607323	Cortisone	14044-2
607324	Cortisone Z-score	95586-4
607325	Tetrahydrocortisone	16116-6
607326	Tetrahydrocortisone Z-score	95587-2
607327	a-Cortolone	55906-2
607328	a-Cortolone Z-score	95588-0
607329	B-Cortolone	95589-8
607330	B-Cortolone Z-score	95590-6
607331	11-Oxoetiocholanolone	6703-3
607332	11-Oxoetiocholanolone Z-score	95591-4
607282	Interpretation	73884-9