MAYO CLINIC LABORATORIES

Test Definition: RFAMA

Renal Function Panel, Serum

Overview

Useful For

Aiding in diagnosis and management of conditions affecting kidney function

General health screening

Screening patients at risk of developing kidney disease

Management of patients with known kidney disease

Profile Information

Test Id	Reporting Name	Available Separately	Always Performed
KS	Potassium, S	Yes	Yes
NAS	Sodium, S	Yes	Yes
CL	Chloride, S	Yes	Yes
HCO3	Bicarbonate, S	Yes	Yes
AGAP	Anion Gap	No	Yes
BUN	Bld Urea Nitrog(BUN), S	Yes	Yes
CRTS1	Creatinine with eGFR, S	Yes	Yes
CA	Calcium, Total, S	Yes	Yes
GLURA	Glucose, Random, S	Yes	Yes
ALB	Albumin, S	Yes	Yes
PHOS	Phosphorus (Inorganic), S	Yes	Yes

Method Name

KS, NAS, CL: Potentiometry
HCO3: Photometric, Enzymatic
AGAP: Calculated result
BUN: Photometric, Urease
CRTS1: Colorimetric
CA: Photometric
GLURA: Photometric
ALB: Photometric, Bromcresol Green
PHOS: Photometric, Ammonium Molybdate

NY State Available

Yes

Specimen

Specimen Type
Serum

Necessary Information
Patient's age and sex are required.

Specimen Required
Collection Container/Tube:
Preferred: Serum gel
Acceptable: Red top
Submission Container/Tube: Plastic vial
Specimen Volume: 0.6 mL
Collection Instructions:
1. Serum gel tubes should be centrifuged within 2 hours of collection.
2. Red-top tubes should be centrifuged and the serum aliquoted into a plastic vial within 2 hours of collection.

Forms
If not ordering electronically, complete, print, and send 1 of the following forms with the specimen:
-Kidney Transplant Test Request
-Renal Diagnostics Test Request (T830)

Specimen Minimum Volume
0.5 mL

Reject Due To

Gross hemolysis	Reject
Gross lipemia	OK

Specimen Stability Information

Specimen Type	Temperature	Time	Special Container
Serum	Refrigerated	24 hours	

Clinical & Interpretive

Clinical Information
This panel could be ordered when a patient has risk factors for kidney dysfunction such as high blood pressure (hypertension), diabetes, cardiovascular disease, obesity, elevated cholesterol, or a family history of kidney disease. This panel may also be ordered when someone has signs and symptoms of kidney disease, though early kidney disease often does not cause any noticeable symptoms. It may be initially detected through routine blood or urine testing.

Reference Values

SODIUM
<1 year: Not established
> or =1 year: 135-145 mmol/L

POTASSIUM
<1 year: Not established
> or =1 year: 3.6-5.2 mmol/L

CHLORIDE
<1 year: Not established
1-17 years: 102-112 mmol/L
> or =18 years: 98-107 mmol/L

BICARBONATE
Males
<1 year: Not established
1-2 years: 17-25 mmol/L
3 years: 18-26 mmol/L
4-5 years: 19-27 mmol/L
6-7 years: 20-28 mmol/L
8-17 years: 21-29 mmol/L
> or =18 years: 22-29 mmol/L

Females
<1 year: Not established
1-3 years: 18-25 mmol/L
4-5 years: 19-26 mmol/L
6-7 years: 20-27 mmol/L
8-9 years: 21-28 mmol/L
> or =10 years: 22-29 mmol/L

ANION GAP
<7 years: Not established
> or =7 years: 7-15

BLOOD UREA NITROGEN (BUN)
Males
<12 months: Not established
1-17 years: 7-20 mg/dL
> or =18 years: 8-24 mg/dL

Females
<12 months: Not established
1-17 years: 7-20 mg/dL
> or =18 years: 6-21 mg/dL

CREATININE
Males
0-11 months: 0.17-0.42 mg/dL
1-5 years: 0.19-0.49 mg/dL
6-10 years: 0.26-0.61 mg/dL
11-14 years: 0.35-0.86 mg/dL
> or =15 years: 0.74-1.35 mg/dL

Females
0-11 months: 0.17-0.42 mg/dL
1-5 years: 0.19-0.49 mg/dL
6-10 years: 0.26-0.61 mg/dL
11-15 years: 0.35-0.86 mg/dL
> or =16 years: 0.59-1.04 mg/dL

ESTIMATED GLOMERULAR FILTRATION RATE (eGFR)

>= 18 years old: > or =60 mL/min/BSA (body surface area)
Estimated GFR calculated using the 2021 CKD-EPI creatinine equation.
Note: eGFR results will not be calculated for patients younger than 18 years old.

CALCIUM
<1 year: 8.7-11.0 mg/dL
1-17 years: 9.3-10.6 mg/dL
18-59 years: 8.6-10.0 mg/dL
60-90 years: 8.8-10.2 mg/dL
>90 years: 8.2-9.6 mg/dL

GLUCOSE
0-11 months: Not established
> or =1 year: 70-140 mg/dL

Total Protein
> or =1 year: 6.3-7.9 g/dL
Reference values have not been established for patients who are younger than 12 months of age.

ALBUMIN
> or =12 months: 3.5-5.0 g/dL
Reference values have not been established for patients who are younger than 12 months of age.

PHOSPHORUS
Males
1-4 years: 4.3-5.4 mg/dL
5-13 years: 3.7-5.4 mg/dL

14-15 years: 3.5-5.3 mg/dL
16-17 years: 3.1-4.7 mg/dL
> or =18 years: 2.5-4.5 mg/dL
Reference values have not been established for patients that are younger than 12 months of age.

Females
1-7 years: 4.3-5.4 mg/dL
8-13 years: 4.0-5.2 mg/dL
14-15 years: 3.5-4.9 mg/dL
16-17 years: 3.1-4.7 mg/dL
> or =18 years: 2.5-4.5 mg/dL
Reference values have not been established for patients that are younger than 12 months of age.

Interpretation

Panel results are not diagnostic but rather indicate that there may be a problem with the kidneys and that further testing is required to make a diagnosis and determine the cause. Results of the panel are usually considered together, rather than separately. Individual test results can be abnormal due to causes other than kidney disease but taken together with risks and signs and symptoms, they may give an indication of whether kidney disease is present.

Cautions

No significant cautionary statements.

Clinical Reference

1. Oh MS: Evaluation of renal function, water, electrolytes, and acid-base balance. In: McPherson RA, Pincus MR, eds. Henry's Clinical Diagnosis and Management by Laboratory Methods. 22nd ed. Elsevier Saunders; 2011:chap 14
2. Renal Panel. Testing.com; Updated November 9, 2021. Accessed July 14, 2022. Available at www.testing.com/tests/renal-panel/

Performance

Method Description

Potassium, Sodium, Chloride:
An ion-selective electrode (ISE) makes use of the unique properties of ion-selective membrane to develop an electrical potential (electromotive force: EMF) for the measurements of ions in solution. Selective membrane is in contact with both the test solution and an internal filling solution. Due to the selectivity of the membrane, only the ions to be measured contribute to the EMF. The membrane EMF is determined by the difference in concentration of the test ion in the test solution and the internal filling solution. The EMF develops according to Nernst equation of a specific ion in solution.(Package insert: ISE indirect Na-K-Cl for Gen 2. Roche Diagnostics; 05/2024)

Bicarbonate:
Bicarbonate reacts with phosphoenolpyruvate (PEP) in the presence of PEPC to produce oxaloacetate and phosphate. That reaction is coupled with one involving the transfer of a hydrogen ion from reduced nicotinamide adenine dinucleotide (NADH) analog to oxaloacetate using malate dehydrogenase. The resultant consumption of NADH analog causes a decrease in absorbance, which is proportional to the concentration of bicarbonate in the sample being

analyzed.(Package insert: Bicarbonate reagent. Roche Diagnostics; 02/2023)

Anion Gap:
This is a calculated result. The following equation is used to calculate the anion gap (A gap):
A gap = Na - (Cl + HCO3-)

Blood Urea Nitrogen (BUN):
Kinetic test with urease and glutamate dehydrogenase. Urea is hydrolyzed by urease to form ammonium and carbonate. In the second reaction 2-oxoglutarate reacts with ammonium in the presence of glutamate dehydrogenase and the coenzyme reduced nicotinamide adenine dinucleotide (NADH) to produce L-glutamate. In this reaction two moles of NADH are oxidized to NAD[+] for each mole of urea hydrolyzed. The rate of decrease in NADH concentrations is directly proportional to the urea concentration in the specimen and is measured photometrically.(Package insert: Urea/BUN reagent. Roche Diagnostics; 07/2024)

Creatinine:
This enzymatic method is based on the conversion of creatinine with the aid of creatininase, creatinase, and sarcosine oxidase to form glycine, formaldehyde, and hydrogen peroxide. Catalyzed by peroxidase the liberated hydrogen peroxide reacts with 4-aminophenazone and HTIB (2,4,6-triiodo03-hydroxybenzoic acid) to form a quinone imine chromogen. The color intensity of the quinone imine chromogen formed is directly proportional to the creatinine concentration in the reaction mixture.(Package insert: Creatinine plus. Roche Diagnostics; 07/2024)

Estimated Glomerular Filtration Rate:
Estimated glomerular filtration rate (eGFR) is calculated using the 2021 Chronic Kidney Disease Epidemiology Collaboration (CKD-EPI) equation:
Females:
If creatinine < or =0.7 mg/dL: 142 x (Scr/0.7)(-0.241) x 0.9938age x 1.012
If creatinine >0.7 mg/dL: 142 x (Scr/0.7)(-1.200) x 0.9938age x 1.012

Males:
If creatinine < or =0.9 mg/dL: 142 x (Scr/0.9)(-0.302) x 0.9938age
If creatinine >0.9 mg/dL: 142 x (Scr/0.9)(-1.200) x 0.9938age
Values are reported for calculated GFR estimates between 15 to 90 mL/min/1.73 m(4). Estimated GFR values outside of this range are reported as "<15 mL/min/1.73 m(2)" or ">90 mL/min/1.73 m(4)" and not as an exact number.

Calcium:
Calcium ions react with 5-nitro-5'-methyl-BAPTA (NM-BAPTA) under alkaline conditions to form a complex. This complex reacts in the second step with EDTA. The change in absorbance is directly proportional to the calcium concentration and is measured photometrically.(Package insert: CA2 reagent. Roche Diagnostics; 08/2023)

Glucose:
Hexokinase catalyzes the phosphorylation of glucose to glucose-6-phosphate by ATP. Glucose-6-phosphate dehydrogenase oxidizes glucose-6-phosphate in the presence of nicotinamide adenine dinucleotide phosphate (NADP) to gluconate-6-phosphate. No other carbohydrate is oxidized. The rate of NADPH formation during the reaction is directly proportional to the glucose concentration and is measured photometrically.(Package insert: Glucose HK Gen.3. Roche Diagnostics; 07/2024)

Albumin:
At a pH value of 4.1, albumin displays a sufficiently cationic character to be able to bind with bromcresol green (BCG), an anionic dye, to form a blue-green complex. The color intensity of the blue-green color is directly proportional to the albumin concentration in the sample and is measured photometrically.(Package insert: Albumin reagent. Roche Diagnostics; V 8.0, 06/2024)

Phosphorus (Inorganic):
Inorganic phosphate forms an ammonium phosphomolybdate complex with ammonium molybdate in the presence of sulfuric acid. The concentration of phosphomolybdate formed is directly proportional to the inorganic phosphate concentration and is measured photometrically.(Package insert: Phosphate (Inorganic). Roche Diagnostics; 10/2023)

PDF Report
No

Day(s) Performed
Monday through Sunday

Report Available
Same day/1 to 2 days

Performing Laboratory Location
Mayo Clinic Laboratories - Rochester Main Campus

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 has been cleared, approved, or is exempt by the US Food and Drug Administration and is used per manufacturer's instructions. Performance characteristics were verified by Mayo Clinic in a manner consistent with CLIA requirements.

CPT Code Information
KS: 84132
NAS: 84295
CL: 82435
HCO3: 82374
BUN: 84520
CRTS1: 82565
CA: 82310

GLURA: 82947
ALB: 82040
PHOS: 84100

LOINC® Information

Test ID	Test Order Name	Order LOINC® Value
RFAMA	Renal Function Panel, S	24362-6

Result ID	Test Result Name	Result LOINC® Value
AGAP	Anion Gap	33037-3
ALB	Albumin, S	1751-7
BUN	Bld Urea Nitrog(BUN), S	3094-0
CL	Chloride, S	2075-0
GLURA	Glucose, Random, S	2345-7
HCO3	Bicarbonate, S	1963-8
PHOS	Phosphorus (Inorganic), S	2777-1
CA	Calcium, Total, S	17861-6
NAS	Sodium, S	2951-2
KS	Potassium, S	2823-3
CRTSA	Creatinine, S	2160-0
EGFR1	Estimated GFR (eGFR)	98979-8