

Estimated Glomerular Filtration Rate (eGFR)

Background Information

The eGFR is an estimation of glomerular filtration rate (GFR), which provides a more accurate means of identifying chronic kidney disease (CKD) than serum creatinine alone. eGFR is calculated using the four-variable equation from the Modification of Diet in Renal Disease (MDRD) Study. The variables are age, gender, ethnicity, and serum creatinine. Because the eGFR can be automated as part of routine lab reporting, the National Kidney Foundation (NKF) recommends automatically reporting it with all serum creatinine measurements (<http://www.kidney.org>). eGFR already is in use by many clinical laboratories.

The NKF defines CKD as the presence for longer than 3 months of either of the following:

1. An eGFR of less than 60 mL/min/1.73 m² or
2. Other evidence of kidney damage (e.g. albuminuria, proteinuria) independent of GFR level.

CKD is estimated to affect approximately 13.1% of the adult American population. CKD has been shown to be an independent risk factor for cardiovascular disease, mortality and progression to end stage renal disease. Therefore, early detection and treatment of CKD is important.

The use of serum creatinine alone to assess kidney function results in unrecognized CKD in a large number of patients, particularly in women and elderly patients who typically have lower serum creatinine values than other patient populations with the same GFR. In such cases, CKD may be missed because a presumed “normal” serum creatinine value will correlate with a lower GFR.

Clinical Indications

To support the effort the National Kidney Foundation’s initiative to identify CKD in its early stages, Cleveland Clinic

Laboratories reports eGFR on each serum creatinine reported for outpatients. The eGFR also can be ordered for inpatients.

Interpretation

Based on the NKF’s “K/DOQI Clinical Practice Guidelines for Chronic Kidney Disease: Evaluation, Classification, and Stratification,” the eGFR should be used for diagnosis and monitoring of CKD. The interpretation of any laboratory information should be done in the context of the patient evaluation. The classification of CKD is as follows:

Stage	eGFR+ (mL/min/1.73m ²)	Evidence of Kidney Damage* Required?
1	>90	Yes
2	60-89	Yes
3	30-59	No
4	15-29	No
5	<15 (or dialysis)	No

Notes:

+These abnormalities must be present for > 3 months to meet the definition of chronic kidney disease.

* Evidence of kidney damage includes abnormal pathologic, blood, urine or radiologic studies.

Limitations of the Assay

The National Kidney Disease Education Program (NKDEP) recommends reporting estimated eGFR values greater than or equal to 60 mL/min/1.73 m² as “≥60 mL/min/1.73 m²”. This is based on the fact that, at higher ranges of kidney function, changes in GFR are reflected by little-to-no change in serum creatinine. As a result, the MDRD eGFR is much less accurate in this range.

In addition, the MDRD equation has not been validated in subjects <18 years old (see Methodology below) or hospitalized patients. The eGFR will not yield accurate results in subjects with extremes of body habitus/muscle mass, with renal function not at steady state (e.g. acute renal failure), or with critical illness admitted to the hospital. In these clinical situations, kidney function assessment is to be made on clinical grounds.

Analysis for PNH is best done within 24 hours of the stated draw time. Blood older than 48 hours from draw time cannot be analyzed.

Methodology

The serum creatinine method used in our laboratory is traceable to a primary material at the NIST based on isotope dilution mass spectrometry. Therefore, according to both the NKF and NKDEP, the eGFR for adults is calculated using the

re-expressed four-variable MDRD study equation which for Scr (mg/dL) is $GFR = 175 \times Scr^{-1.154} \times age^{-0.203} \times 1.212$ (if black) $\times 0.742$ (if female).

The eGFR for children is calculated based on the Schwartz equation which for Scr (mg/dL) and height (cm) is $GFR (mL/min/1.73m^2) = k \times height / Scr$ with $k = 0.55$ except that male > 13 years $k = 0.7$.

The eGFR is reported for outpatients with any serum creatinine order either as a single test or as part of a chemistry panel, i.e., Comprehensive Metabolic Panel (CMP), Basic Metabolic Panel (BMP), etc.

Suggested Reading

1. <http://www.kidney.org>
2. <http://www.nkdep.nih.gov/labprofessionals/index.htm>

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