Kidney news
Volume 7 Issue 1 November 2005

eGFR.
Estimation of the Glomerular Filtration Rate in the assessment of renal function.

Case 1

A 23 year old male body builder presented for a "check-up". He was otherwise well. He had lost a kidney from freak accident at the age of ten years. Weight 72kg. Large muscular body bulk in chest and thighs. BMI 25.5kg/m^2. BP 112/68mmHg. Remainder of physical examination normal. All laboratory tests normal, including MSU, except his serum creatinine which was 130µmol/L (0.130mmol/L). cGFR (calculated GFR) = 74ml/min/1.73m^{2}BSA; eGFR = 80ml/min/1.73m^{2}BSA. 24 hour urine creatinine clearance = 108ml/min.

Why the discrepancy between the GFRs?

The cGFR (corrected Cockcroft and Gault equation) and the eGFR (MDRD) formulae, correct for body size – the result is in ml/min/1.73m^2 body surface area. These equations assume the patient is of "normal" proportion of fat, bone, water and muscle. The body builder does not fit the equation. Their muscle mass is disproportionately larger. A similar miscalculation is noted in very thin or elderly people, and oedematous states. Using the ideal body weight in the equation helps remove these errors, however, the ideal body weight is not always easy or accurately assessed. An accurately collected 24-hour urine is a better measure than the calculators.

So which calculation should we use in normal people?

The serum creatinine varies considerably throughout the day according to the degree of hydration and dietary intake of the individual; and when added to the fluctuation in laboratory measurement, up to 20% changes in measured creatinine (and therefore GFR) occur. In 1997 the Modification of Diet in Renal Disease trial was first published, using the MDRD GFR formula, which was specifically designed for the study. The MDRD GFR formula – as it currently stands – is the best estimate of true renal GFR based on the serum creatinine, corrected for body size. It does have its limitations – two of which are that the MDRD equation is only suitable for an eGFR below 60ml/min/1.73m^2 BSA; and ages 18 years and older.

Case 2

A 74-year old woman has a routine serum creatinine of 150µmol/L (0.15mmol/L). BMI 25.7kg/m^2. eGFR = 30ml/min/1.73m^2. What appears to be a mildly elevated serum creatinine, in fact reflects severe renal failure in an older woman. Without the calculation of an eGFR; it is easy to overlook the severity of her renal failure.

So what if the eGFR is greater than 60ml/min/1.73m^2 BSA (body surface area)?

Although in an otherwise healthy young person an eGFR >60ml/min/1.73m^2 may reflect significant renal impairment; and referral to a renal physician be indicated; the muscle mass in this group usually is not reduced to a degree where the production of creatinine is so low as to falsely lead the clinician into the patient having healthy kidneys. Secondly, the middle and older age groups, and especially female gender (where the % muscle mass (and therefore creatinine production) is normally lower than that of males for the same boy size) often have low creatinine production, a relatively low serum creatinine; and when applying the reference range of serum creatinine of younger individuals to the creatinine result in this age group the clinician is falsely reassured in to the patient having better renal function than truly exists. This has always been a clinical issue. Each calculation of creatinine clearance (estimation of GFR) has been fraught with its own errors. There are over 45 different calculators of GFR in use. The corrected Cockcroft and Gault equation has been widely accepted as one of the better estimates of GFR. It is by no means perfect, but is better than a serum creatinine measurement on its own. The Cockcroft-Gault equation is the basis of medication dosing adjustment in most clinical trials. It is not standardised or validated against a gold standard in many ethnic groups, and common ethnic groups in our practice: Asians; Pacific Islanders and Maori are not validated. Similarly the MDRD equation is not validated yet in these races. The MDRD equation, however, when compared with a gold standard measure of GFR (iothalamate clearance) is more accurate at estimating the GFR than the Cockcroft-Gault equation below 60ml/min. The Cockcroft-Gault equation requires the patient's height and weight. As a result, we have moved to the widespread use of the MDRD equation to estimate the GFR (eGFR) in clinical medicine in New Zealand. The eGFR using the short MDRD equation will now be reported by laboratories whenever the serum creatinine is requested.

eGFR calculation

This complete calculation uses age, gender, race, serum albumin, urea and creatinine to estimate the GFR. The short version uses age, gender and serum creatinine only. The short version has been validated as a satisfactory eGFR in clinical medicine, and removes the need for four other parameters to be recorded or measured.

eGFR (male) = $186 * [(\text{creatinine})/88.4]^{-1.154} * \text{age}^{-0.203}$
eGFR (female) = $138 * [(\text{creatinine})/88.4]^{-1.154} * \text{age}^{-0.203}$

Units: creatinine: µmol/L. Age: years, but >18.

Kidney news is produced in the interest of education of all medical practitioners in the management of kidney disease or general conditions that may affect the kidneys.
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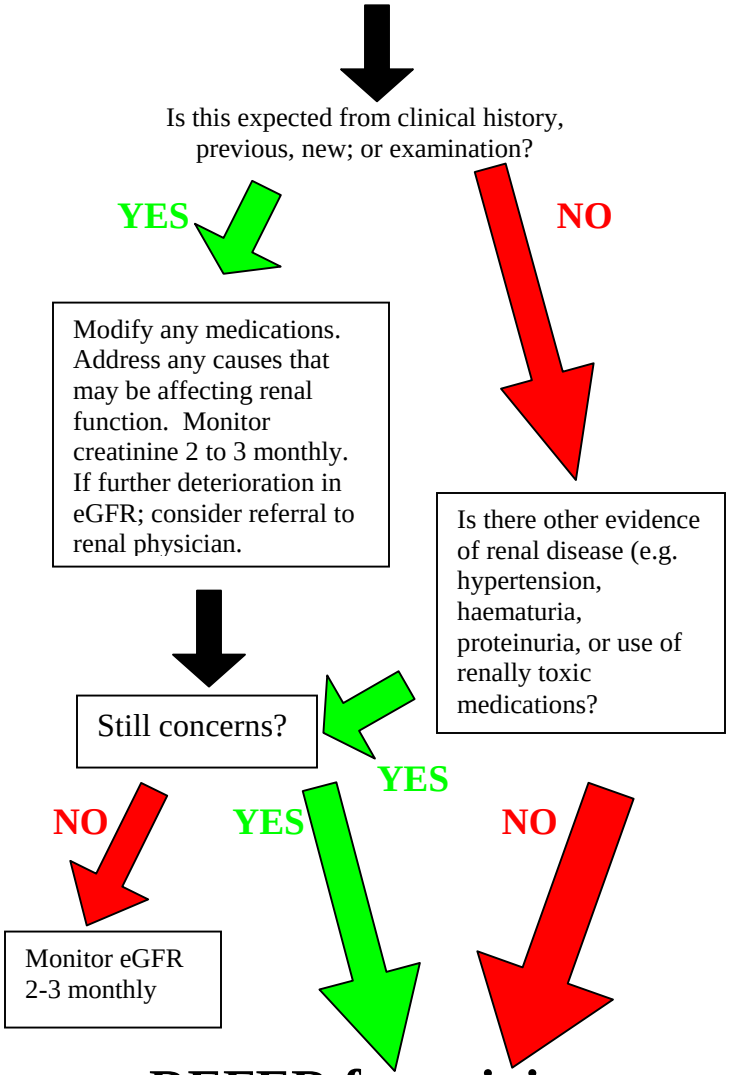
Limitations

If identified on the request form, eGFR will not be reported in chronic dialysis patients. eGFR will be reported for all ethnic groups; but care must be taken to realise this equation has not been validated outside, European and African-American dissent populations. The eGFR is not relevant in acute renal failure (ARF), and resolving ARF. No GFR estimate or calculation is applicable in severe clinical situations: e.g. muscle wasting disorders, amputations, body builders, extremes of protein diet e.g. vegans, Atkins diet. Care must be taken in the interpretation of the laboratory automatically reported eGFR in these groups.

An approach to the low eGFR

eGFR < 60ml/min/1.73m^2 BSA



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