

Assessing Renal Function for Drug Dose Adjustments in Primary Care

Key learning points

- Information which drugs require dose adjustments in renal impairment can be found in the latest British National Formulary (BNF)¹ and Summary Product Characteristics (SmPC).²
- Prescribers are reminded to use the most appropriate method of estimating renal function to determine dose adjustments for patients with renal impairment.
- eGFR estimates are supplied on many laboratory results reports and are suitable for most drugs in patients of average height and build – but not all eg direct oral anticoagulants (DOACS).
- Creatinine clearance should be calculated using the Cockcroft-Gault equation for some medicines, for patients >75yrs and for those with extremes of muscle mass.³
- Creatinine clearance should ALWAYS be used to inform dose adjustment for direct oral anticoagulants using ACTUAL BODY WEIGHT.⁴
- Reassess renal function and drug dosing in situations where eGFR and/or CrCl change rapidly, such as in patients with acute kidney injury (AKI).

When should Drug Dose Adjustments in Renal Impairment be applied?

Many medications will require an adjustment to the standard dose recommendations for patients with reduced renal function to reduce the risk of toxicity and overdose.

Guidance on these adjustments for individual medications can be found in the BNF¹ and the SmPC². Depending on the drug either eGFR or CrCl thresholds will be quoted. Please be aware that eGFR ranges for classification of chronic kidney disease (e.g. by NICE) may be different to those used in guidance for adjustment of drug treatments.

Doses may need further adjustment according to clinical response and any plasma concentration results.

For patients on renal replacement therapies (e.g. haemodialysis or peritoneal dialysis) consult specialist texts such as The Renal Drug Handbook.⁵ Some medicines are unsuitable for patients with a low renal clearance and alternatives should be used

How to Estimate Renal Function for Drug Dose Adjustments

Estimated glomerular filtration rate (eGFR) is supplied on many laboratory results reports and is suitable for most drugs in patients of average height and build.³

Creatinine clearance (CrCl) is another estimate of renal function that takes into account the height and weight of the patient and is more accurate than eGFR. CrCl can be calculated using the **Cockcroft & Gault (C&G) Equation** :

$$\text{CrCl (ml/min)} = \frac{((140 - \text{age years}) \times \text{weight kg})}{\text{Serum creatinine } \mu\text{mol/ml}} \times C \quad \text{where C is 1.23 for males and 1.04 for females}$$

CrCl is more suitable to use³ for dose calculations and adjustments when:

- Drugs that are nephrotoxic or have a narrow therapeutic index and high renal excretion
- Patients that are over 75 years old or those with a BMI <18kg/m² or >40kg/m²

Which weight parameter should be used in the C&G equation?

- For most medicines the weight used in the C&G calculation should be the ideal body weight.⁴
- For DOAC dosing actual body weight should be used⁴
- For some situations an adjusted body weight can be used. This is usually for drugs with a high risk of toxicity when the patients actual weight is >30% over his or her ideal body weight (less common in primary care).
- When prescribing for patients where it has not been possible to measure their current weight, the risk of over or under estimating renal clearance using eGFR should be taken into account when determining drug dosing.

Online Calculators for CrCl

MD+CALC is an online tool that can calculate CrCl. This displays three CrCl calculations for a variety of weight parameters (ideal, actual and adjusted body weights). This enables clinicians to utilise the most appropriate estimated CrCl for the clinical situations and the drug being prescribed.^{6,7}

GP Clinical System Calculators for CrCl

GP Clinical systems such as **EMIS** and **SystemOne** have inbuilt calculators for calculation of creatinine clearance. Both have limitations regarding the selection of the different calculation methods for different circumstances. For example the system may default to the calculation method suitable for a DOAC for a patient prescribed both a DOAC and another drug (this drug may require a different calculation method). **Ensure you are familiar with the current limitations on your system before using these.**

Methods for Calculating an Estimated Renal Function for Drug Dose Adjustments in Primary Care

A recent serum creatinine level will be required for all calculations. Serum creatinine values are more stable in chronic renal disease. If renal function is declining rapidly, more frequent calculations and dose adjustments will be required. Creatinine clearance calculations (using IBW) will require a patient's recent weight(kg) and height(cm).

	Method of Calculation	When to use	Limitations
Estimated glomerular filtration rate (eGFR)	Provided with laboratory test results Normalised to a body surface area of 1.73m ²	<ul style="list-style-type: none"> Suitable for most drugs in patients of average height and build. Check the BNF or SmPC to confirm the correct method to calculate the dose of a drug in a patient with renal impairment. 	<ul style="list-style-type: none"> Inaccurate in people at extremes of body type e.g. patients with limb amputations, severely malnourished, morbidly obese and underweight Laboratory reports may already calculate this when reporting serum creatinine Patient's height and weight is not required and not taken into account – the calculation is based on serum creatinine, age, sex and, on some systems, race. eGFR overestimates renal function increasingly as age increases. Use of CrCl is preferable in patients >75years old.
Creatinine Clearance (CrCl) using IDEAL body weight	Calculate using Cockcroft and Gault Equation	<ul style="list-style-type: none"> Patients taking nephrotoxic drugs (e.g. gentamicin and vancomycin). Patients taking medicines that are largely renal excreted and have a narrow therapeutic index (e.g. digoxin, lithium). Check the latest BNF/SmPC for guidance. Elderly patients over 75 years old (except for DOACs). Patients with BMI <18kg/m² or >40kg/m² (except for DOACs). For any drug requiring a dose adjustment based on CrCl as specified in the SmPC. 	<ul style="list-style-type: none"> Requires the height and a recent weight for the patient More accurate than eGFR Can be calculated using MD+CALC Some drugs with high toxicity (e.g. Lithium) will require individualised dosing informed by plasma levels.
Creatinine Clearance (CrCl) using ACTUAL body weight	Calculate using Cockcroft and Gault Equation	<ul style="list-style-type: none"> To estimate renal function for DOAC dosing.⁴ 	<ul style="list-style-type: none"> Do NOT use for DOAC patients with BMI > 40kg/m² or Weight > 120kg unless directed to do so by an anticoagulant specialist Can be calculated using MD+CALC⁶

References

- National Institute for Clinical Excellence. [British National Formulary. Prescribing in Renal Impairment.](#) Accessed January 2020.
- [Electronic Medicines Compendium.](#)
- Medicines and Healthcare Products Regulatory Agency. [Prescribing medicines in renal impairment: using the appropriate estimate of renal function to avoid the risk of adverse drug reactions.](#) October 2019
- Surrey and North Sussex Area Prescribing Committee. [Calculating Creatinine Clearance for DOACs. April 2020.](#)
- The Renal Handbook (5th edition) 2018. CRC Press. Edited by Caroline Ashley and Aileen Dunleavy
- MD+CALC [Creatinine Clearance \(Cockcroft & Gault Equation\)](#)
- MD+CALC [Ideal Body Weight and Adjusted Body Weight](#)

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