ANTIMICROBIAL DOSING IN ADULTS WITH RENAL IMPAIRMENT

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ALL-WALES ANTIMICROBIAL PHARMACISTS' GROUP

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REFERENCES

Doses are taken from the Renal Drug Database which may recommend dosing outside the product licence, and are based upon creatinine clearance estimated using the Cockcroft and Gault equation. eGFR may be used as an estimate for creatinine clearance, but the Cockcroft and Gault equation should be used for high risk patients including patients with a BMI 40 kg/m^2 , or >75 years of age. Consider using the Cockcroft and Gault equation in the elderly, body builders, amputees, patients with a muscle-wasting disease and vegans. In under or overweight patients, use in collaboration with the antimicrobial guideline 'dosing in extremes of body weight'. This guideline will be reviewed every 12 months, however for the most up to date guidance, please refer to the Renal Drug Database.

CREATININE CLEARANCE

Estimated creatinine clearance (mL/minute)	Male	$\frac{(140\text{-age in years}) \times \text{ideal body weight (kg)}}{\text{serum creatinine (µmol/L)}} \times 1.23$
	Female	$\frac{(140\text{-age in years}) \times \text{ideal body weight (kg)}}{\text{serum creatinine (µmol/L)}} \times 1.04$

Patients' ideal body weight based on their height can be calculated using the formulae below. For ease of use, a reference table is provided

- **Males: Ideal body weight (kg) = 50kg + 0.9kg for every cm height over 152cm**
- **Females: Ideal body weight (kg) = 45.5kg + 0.9kg for every cm height over 152cm**

ADULT FEMALES (> 16 yrs)		ADULT MALES (>16 yrs)	
Height	IBW (kg)	Height	IBW (kg)
≥191cm (6'3")	≥80.6	≥191cm(6' 3")	85.1
188cm (6'2")	77.9	188cm (6' 2")	82.4
185cm (6'1")	75.2	185cm (6' 1")	79.7
183cm (6')	73.4	183cm (6')	77.9
180cm (5'11")	70.7	180cm(5' 11")	75.2
178cm (5'10")	68.9	178cm(5' 10")	73.4
175cm (5'9")	66.2	175cm (5' 9")	70.7
173cm (5' 8")	64.4	173cm (5' 8")	68.9
170cm (5' 7")	61.7	170cm (5' 7")	66.2
168cm (5' 6")	59.9	168cm (5' 6")	64.4
165cm (5' 5")	57.2	165cm (5' 5")	61.7
163cm (5' 4")	55.4	163cm (5' 4")	59.9
160cm (5' 3")	52.7	160cm (5' 3")	57.2
157cm (5' 2")	50	157cm (5' 2")	54.5
155cm (5' 1")	48.2	155cm (5' 1")	52.7
≤152cm (5')	≤45.5	≤152cm (5')	≤50

DOSE RECOMMENDATIONS

ACICLOVIR FOR HERPES SIMPLEX

ORAL DOSE

CrCl > 25 ml/min: 200mg – 400mg 5 x /day. For prophylaxis reduce dosing frequency to qds

CrCl 10 – 25 ml/min: 200mg tds/qds

CrCl < 10 ml/min: 200mg bd

INTRAVENOUS DOSE

CrCl > 50 ml/min: 5-10mg/kg tds. For encephalitis use 10mg/kg

CrCl 25 – 50 ml/min: 5-10mg/kg bd. For encephalitis use 10mg/kg

CrCl 10 – 25 ml/min: 5-10mg/kg od (some units use 3.5-7mg/kg od). For encephalitis use 10mg/kg

CrCl < 10 ml/min: 2.5-5mg/kg od. For encephalitis use 5mg/kg

ACICLOVIR FOR VARICELLA ZOSTER

Note: Where a dosage range is given, the higher dose should be reserved for severely immunocompromised patients as they may require higher doses than those quoted.

ORAL DOSE

CrCl > 25 ml/min: 800mg 5 x /day

CrCl 10 – 25 ml/min: 800mg bd/tds

CrCl < 10 ml/min: 400mg – 800mg bd

INTRAVENOUS DOSE

CrCl > 50 ml/min: 5-10mg/kg tds. For encephalitis use 10mg/kg

CrCl 25 – 50 ml/min: 5-10mg/kg bd. For encephalitis use 10mg/kg

CrCl 10 – 25 ml/min: 5-10mg/kg od (some units use 3.5-7mg/kg od). For encephalitis use 10mg/kg

CrCl < 10 ml/min: 2.5-5mg/kg od. For encephalitis use 5mg/kg

AMBISOME

DOSE AS IN NORMAL RENAL FUNCTION

AMOXICILLIN

ORAL DOSE

CrCl ≥10 ml/min: 250mg – 1g tds. Maximum 6g/day

CrCl <10 ml/min: 250mg – 1g tds

INTRAVENOUS DOSE

CrCl ≥10 ml/min: 250mg – 1g tds. Maximum 6g/day, up to 12g in endocarditis or meningitis

CrCl <10 ml/min: 250mg – 1g tds. Maximum 6g/day in endocarditis or meningitis

AMPICILLIN

ORAL OR INTRAVENOUS DOSE

CrCl >20 ml/min: Dose as in normal renal function

CrCl 10-20 ml/min: 250 mg – 2 g every 6 hours

CrCl <10 ml/min: 250 mg –1 g every 6 hours

ANIDULAFUNGIN

DOSE AS IN NORMAL RENAL FUNCTION

AZITHROMYCIN

DOSE AS IN NORMAL RENAL FUNCTION. IN PATIENTS WITH CRCL<10ML/MIN A 33% INCREASE IN SYSTEMIC EXPOSURE TO AZITHROMYCIN WAS SEEN THEREFORE THE MANUFACTURER ADVISES TO USE WITH CAUTION.

AZTREONAM

INTRAVENOUS OR INTRAMUSCULAR (IV ROUTE RECOMMENDED FOR SINGLE DOSES >1 G)

CrCl 30–50 ml/min: Dose as in normal renal function.

CrCl 10–30 ml/min: IV: 1–2 g loading dose, then maintenance of 50% of appropriate normal dose

CrCl: <10 ml/min: 1–2 g loading dose, then maintenance of 25% of appropriate normal dose

BENZYLPENICILLIN

Note: Higher doses (>7.2g/day) should be reserved for the treatment of meningitis, severe cellulitis or endocarditis

INTRAVENOUS DOSE

CrCl > 20 ml/min: 2.4g – 14.4g daily in 4 – 6 divided doses.

CrCl 10 – 20 ml/min: 600mg – 2.4g qds, depending on severity of infection

CrCl < 10 ml/min: 600mg – 1.2g qds, depending on severity of infection

CASPOFUNGIN

INTRAVENOUS DOSE

Dose as in normal renal function.

In established renal failure the AUC is increased by 30–49% but a change in dosage schedule is not required

CEFALEXIN

ORAL DOSE

CrCl > 10-40 ml/min: 250-500mg BD-TDS Recurrent UTI prophylaxis: 125mg at night

CrCl <10 ml/min: 500mg OD-BD

CEFOTAXIME

INTRAVENOUS DOSE

CrCl ≥ 5 ml/min: Mild infection: 1g bd. Moderate infection: 1g tds. Severe infection: 2g qds. Life-threatening infection: up to 12g daily in 3 – 4 divided doses.

CrCl < 5 ml/min: Reduce dose by 50% and keep the frequency the same

CEFTAZIDIME

INTRAVENOUS OR INTRAMUSCULAR DOSE

CrCl 31–50 ml/min: 1–2 g every 12 hours

CrCl 16–30 ml/min: 1–2 g every 24 hours

CrCl 6–15 ml/min: 500 mg – 1 g every 24 hours

CrCl: <5 ml/min: 500 mg – 1 g every 48 hours

CEFTOLOZANE/TAZOBACTAM (ZERBAXA)

INTRAVENOUS DOSE

CrCl 30–50 ml/min: 500mg ceftolozane/250mg tazobactam TDS

HAP/VAP: 1g/500mg TDS

CrCl 15-29 ml/min: 250mg ceftolozane/125mg tazobactam TDS

HAP/VAP: 500mg/250mg TDS

CrCl <15 ml/min: 500mg ceftolozane/250mg tazobactam STAT then 100mg ceftolozane/50mg tazobactam TDS

HAP/VAP: 1.5g/750mg STAT then 300/150mg TDS

CEFTRIAXONE

INTRAVENOUS DOSE

CrCl ≥ 10 ml/min: 1g od; 2 – 4g daily in severe infections

CrCl < 10 ml/min: Dose as in normal renal function, maximum 2g daily

CEFUROXIME

INTRAVENOUS DOSE

CrCl >20 ml/min: 750mg-1.5g every 6-8 hours

CrCl 10 – 20 ml/min: 750mg – 1.5g bd

CrCl <10 ml/min: 750mg – 1.5g od

CIPROFLOXACIN

ORAL DOSE

CrCl >30 ml/min: 250mg – 750mg bd

CrCl 10 – 30 ml/min: 50% - 100% of normal dose

CrCl <10 ml/min: 50% of normal dose (100% dose may be given for short periods under exceptional circumstances)

INTRAVENOUS DOSE

CrCl >30 ml/min: 100mg – 400mg bd/tds

CrCl 10 – 30 ml/min: 50% - 100% of normal dose

CrCl <10 ml/min: 50% of normal dose (100% dose may be given for short periods under exceptional circumstances)

CLARITHROMYCIN

ORAL DOSE

CrCl >30 ml/min: 250mg – 500mg bd

CrCl <30 ml/min: 250mg – 500mg bd

Patients with GFR<10 mL/min, vomiting may be a problem with high doses.

INTRAVENOUS DOSE

CrCl >30 ml/min: 500mg bd

CrCl <30 ml/min: 250mg – 500mg bd

Patients with GFR<10 mL/min, vomiting may be a problem with high doses.

CLINDAMYCIN

Dosage may require reduction in patients with severe renal impairment due to prolonged half-life.

CO-AMOXICLAV

ORAL DOSE

CrCl >30 ml/min: 375mg – 625mg tds

CrCl <30 ml/min: Dose as in normal renal function

INTRAVENOUS DOSE

CrCl >30 ml/min: 1.2g tds. Up to qds in severe infections

CrCl 10-30 ml/min: 1.2g bd

CrCl <10 ml/min: 1.2g stat followed by either 600mg tds or 1.2g bd

COLISTIMETHATE SODIUM (COLISTIN)

INTRAVENOUS DOSE

NB: Normal loading dose in treatment of Carbepenam Resistant Organisms (CROs)/Carbapenemase-Producing Enterobacteriaceae (CPE) and critically ill patients

CrCl 30 – 50 ml/min: 2.75-3.75 million units every 12 hours

CrCl 10 – 30 ml/min: 2.25-2.75 million units every 12 hours

CrCl <10 ml/min: 1.75 million units every 12 hours

OTHER ROUTES

Dose as in normal renal function

CO-TRIMOXAZOLE

ORAL OR INTRAVENOUS DOSE: STANDARD INDICATIONS

CrCl >30 ml/min: dose as in normal renal function.

CrCl 15–30 ml/min: 50% of dose

CrCl <15 ml/min: 50% of dose

ORAL OR INTRAVENOUS DOSE: PCP

While therapeutic drug monitoring (TDM) is not routinely used with co-trimoxazole, immunocompromised patients and those with impaired renal function and pneumocytis jiroveci pneumonia (PCP) will need TDM to monitor levels.

CrCl >30 ml/min: dose as in normal renal function.

CrCl 15–30 ml/min: 60 mg/kg twice daily for 3 days then 30 mg/kg twice daily.

CrCl <15 ml/min: 30 mg/kg twice daily (This should only be given if haemodialysis facilities are available)

DAPTOMYCIN

INTRAVENOUS DOSE

CrCl ≥30 ml/min: Dose as in normal renal function.

CrCl <30 ml/min: 4-6 mg/kg every 48 hours.

DOXYCYCLINE

DOSE AS IN NORMAL RENAL FUNCTION

ERTAPENEM

INTRAVENOUS DOSE

CrCl >30 ml/min: 1g od

CrCl 10-30 ml/min: Use 50% – 100 % of dose

CrCl <10 ml/min: Use 50% of dose or 1g three times per week

ERYTHROMYCIN

DOSE AS IN NORMAL RENAL FUNCTION

FIDAXOMICIN

DOSE AS IN NORMAL RENAL FUNCTION, ALTHOUGH UK DATA SHEET ADVISES TO USE WITH CAUTION IF GFR<30ML/MIN DUE TO LACK OF DATA

FLUCLOXACILLIN

ORAL DOSE

CrCl >10 ml/min: Dose as in normal renal function

CrCl <10 ml/min: 250mg –500mg qds

INTRAVENOUS DOSE

CrCl >10 ml/min: 250mg – 2g qds. Endocarditis: Maximum 2g every 4 hours (if weight >85kg). Osteomyelitis: 8g/day in divided doses

CrCl <10 ml/min: Dose as in normal renal function up to a total daily dose of 4g

FLUCONAZOLE

ORAL OR INTRAVENOUS DOSE

No dose adjustment is required for single dose therapy.

CrCl 10-50 ml/min: 50–100% of normal dose

CrCl <10 ml/min: 50% of normal dose

FLUCYTOSINE

Consider monitoring blood levels – discuss with microbiology

ORAL OR INTRAVENOUS DOSE

CrCl 20-40 ml/min: 50 mg/Kg 12 hourly

CrCl 10-20 ml/min: 50 mg/Kg 24 hourly

CrCl <10 ml/min: 50 mg/Kg then dose according to levels. Dose of 0.5–1 g daily is usually adequate

FOSFOMYCIN

ORAL DOSE

CrCl >10 ml/min: Dose as in normal renal function

CrCl <10 ml/min: Contra-indicated due to prolonged half-life (in severe renal impairment a 3 g dose can maintain therapeutic plasma levels for 7–10 days)

INTRAVENOUS DOSE

CrCl 31–40 ml/min: Normal loading dose for 1st dose. 70% of dose in 2–3 divided doses

CrCl 21–30 ml/min: Normal loading dose for 1st dose. 60% of dose in 2–3 divided doses

CrCl 11–20 ml/min: Normal loading dose for 1st dose. 40% of dose in 2–3 divided doses

CrCl <10 ml/min: Normal loading dose for 1st dose. 20% of dose in 1–2 divided doses

GANCICLOVIR

INTRAVENOUS DOSE FOR INDUCTION/TREATMENT OF ACTIVE CMV DISEASE

CrCl 50-69 ml/min: 2.5 mg/kg 12 hourly

CrCl 25-49 ml/min: 2.5 mg/kg/day.

CrCl 10-24 ml/min: 1.25 mg/kg/day.

CrCl <10 ml/min: 1.25 mg/kg 3 times a week.

INTRAVENOUS DOSE FOR MAINTENANCE FOR CMV RETINITIS UNTIL RECOVERY OF ADEQUATE IMMUNITY

CrCl 50-69 ml/min: 2.5 mg/kg/day.

CrCl 25-49 ml/min: 1.25 mg/kg/day.

CrCl 10-24 ml/min: 0.625 mg/kg/day.

CrCl <10 ml/min: 0.625 mg/kg three times a week.

GENTAMICIN

N.B. For endocarditis and other multiple daily dosing regimens please speak with your pharmacist

Exclusion criteria for once daily dosing are: severe renal impairment, post- pregnancy and post-partum women, endocarditis, dialysis, ascites, cystic fibrosis and fibrosis and major burns (more than 20% of body)

INTRAVENOUS ONCE DAILY DOSING

See local policy

IMIPENEM/CILASTATIN

Doses expressed as imipenem

INTRAVENOUS DOSE

CrCl 60-90ml/min: 400-500mg QDS or 750mg TDS

CrCl 30-60ml/min: 300mg QDS or 500mg TDS_QDS

CrCl 15-30ml/min: 200mg QDS or 500mg BD

CrCl <15ml/min: 200mg QDS or 500mg BD as long as haemodialysis will be started within 48 hours

LEVOFLOXACIN

INTRAVENOUS/ORAL DOSE

CrCl >50 ml/min: 250mg – 500mg od/bd

CrCl 20-50 ml/min: Initial dose 250mg – 500mg then 125mg – 250mg 12 – 24 hourly

CrCl 10-20ml/min: Initial dose 250-500mg then 125mg 12-48 hourly

CrCl <10ml/min: Initial dose 250mg – 500mg then 125mg 24 – 48 hourly

LINEZOLID

ORAL DOSE

CrCl >10 ml/min: 600mg bd

CrCl <10 ml/min: 600mg bd but monitor closely. If platelet count drops consider reducing to 600mg od

INTRAVENOUS DOSE

CrCl >10 ml/min: 600mg bd

CrCl <10 ml/min: 600mg bd but monitor closely. If platelet count drops consider reducing to 600mg od

MEROPENEM

INTRAVENOUS DOSE

CrCl >50 ml/min: 500mg – 1g tds, up to 2g tds in meningitis / cystic fibrosis

CrCl 26-50 ml/min: 500mg – 2g bd

CrCl 10-25 ml/min: 500mg – 1g bd or 500mg tds

CrCl <10 ml/min: 500mg – 1g od

METRONIDAZOLE

DOSE AS IN NORMAL RENAL FUNCTION

MOXIFLOXACIN

DOSE AS IN NORMAL RENAL FUNCTION

NITROFURANTOIN

ORAL DOSE MODIFIED RELEASE CAPSULES

CrCl >60 ml/min: 100mg BD

CrCl -45-60 ml/min: 100mg BD Use with caution due to increased risk of side effects and treatment failure

CrCl <45ml/min: Contra-indicated: drug ineffective due to reaching inadequate urine concentration. Toxic plasma concentrations can occur with adverse effects e.g. neuropathy, blood dyscrasias.

A short course (3 to 7 days) may be used with caution in certain patients with an eGFR of 30 to 44 ml/min/1.73m^2. Only prescribe to such patients to treat lower urinary tract infection with suspected or proven multidrug resistant pathogens when the benefits of nitrofurantoin are considered to outweigh the risks of side effects.

ORAL DOSE STANDARD RELEASE TABLETS

CrCl >60 ml/min: 50mg – 100mg qds (or once nightly for prophylaxis)

CrCl -45-60 ml/min: 50mg – 100mg qds (or once nightly for prophylaxis). Use with caution due to increased risk of side effects and treatment failure

CrCl <45ml/min: Contra-indicated: drug ineffective due to reaching inadequate urine concentration. Toxic plasma concentrations can occur with adverse effects e.g. neuropathy, blood dyscrasias.

A short course (3 to 7 days) may be used with caution in certain patients with an eGFR of 30 to 44 ml/min/1.73m^2. Only prescribe to such patients to treat lower urinary tract infection with suspected or proven multidrug resistant pathogens when the benefits of nitrofurantoin are considered to outweigh the risks of side effects.

OSELTAMIVIR

NB: these doses differ from that in the SPC and Public Health England and Scotland guidance, and are advised based on clinical experience and the good tolerability of oseltamivir

ORAL DOSE FOR TREATMENT OF INFLUENZA

CrCl ≥30 ml/min: Dose as in normal renal function.

CrCl 10-30 ml/min: 75 mg once daily or 30 mg twice daily

CrCl <10 ml/min: 75mg as a single dose

ORAL DOSE FOR PROPHYLAXIS OF INFLUENZA

CrCl ≥30 ml/min: Dose as in normal renal function.

CrCl 10-30 ml/min: 75 mg every 48 hours or 30 mg once daily

CrCl <10 ml/min: 30 mg once a week (2 doses).

PHENOXYMETHYLPENICILLIN (PENICILLIN V)

DOSE AS IN NORMAL RENAL FUNCTION

PIPERACILLIN/TAZOBACTAM

INTRAVENOUS DOSE

CrCl >40 ml/min: 4.5g tds-qds

CrCl 20-40 ml/min: 4.5g tds

CrCl <20 ml/min: 4.5g bd

PIVMECILLINAM

ORAL DOSE

CrCl >10 ml/min: Dose as in normal renal function

CrCl <10 ml/min Dose as in normal renal function, however unlikely to work in people with little residual kidney function as works by renal excretion into the bladder, where its site of action is. Accumulation may occur in patients with severe renal impairment, so use the lower dose if using for extended periods of time.

RIFAMPICIN

ORAL DOSE

CrCl >10 ml/min: 600mg – 1200mg daily in 2-4 divided doses

CrCl <10 ml/min: 50-100% of normal dose

INTRAVENOUS DOSE

CrCl >10 ml/min: 600mg – 1200mg daily in 2-4 divided doses

CrCl <10 ml/min: 50-100% of normal dose

SODIUM FUSIDATE

DOSE AS IN NORMAL RENAL FUNCTION

TEDIZOLID

DOSE AS IN NORMAL RENAL FUNCTION

TEICOPLANIN

INTRAVENOUS DOSE

See local policy

TEMOCILLIN

INTRAVENOUS DOSE

CrCl 30-60 ml/min: 1g every 12 hours

CrCl 10-30 ml/min: 1g daily.

CrCl <10 ml/min: 1g every 48 hours or 500mg daily.

TIGECYCLINE

DOSE AS IN NORMAL RENAL FUNCTION

TOBRAMYCIN

CrCL 20-50 mL/min: Give 1–2 mg/kg then dose according to serum levels.

CrCL <20 /min: Give 1 mg/kg then dose according to serum levels.

TRIMETHOPRIM

ORAL DOSE

CrCl >15 ml/min: 200mg bd or 100mg nocte for prophylaxis

CrCl <15 ml/min: 50-100% of normal dose

VANCOMYCIN

ORAL DOSE

Dose as in normal renal function

INTRAVENOUS DOSE

See local policy

VORICONAZOLE

DOSE AS IN NORMAL RENAL FUNCTION.

Only use IV in renal patients if patient is unable to tolerate oral, as intravenous vehicle (SBECD) accumulates in renal failure.

DISCLAIMER

Some doses may not reflect those in product literature.

REFERENCES

1. Ashley C, Dunleavy A. The Renal Drug Database. Available at: https://renaldrugdatabase.com/
2. Jodoin K. The Renal Drug Handbook: The Ultimate Prescribing Guide for Renal Practitioners, 4th edition.