'THINK KIDNEYS'

Table1. Acute Kidney Injury: Recommended response times to AKI Warning Stage Test Results for Adults in Primary Care

AKI Warning Stage Test Result Confirm or refute automated AKI Test Result by comparing patient's current creatinine **within clinical context** against baseline creatinine	**Clinical Context Within Which Blood Test Taken#** If clinical context is unknown, then assume high pre-test probability until proven otherwise	
	LOW Pre-test Probability of AKI Stable Clinical Context	**HIGH Pre-test Probability of AKI** Context of Acute Illness
AKI Warning Stage 1 Current creatinine ≥1.5 x baseline level (or creatinine rise >26 mol/L 48 hrs)	**Consider clinical review ≤ 72 hours of e-alert*** **If AKI confirmed** → manage as per table 2	**Consider clinical review ≤ 24 hours of e-alert*** **Likely Stage 1 AKI** → manage as per table 2
AKI Warning Stage 2 Current creatinine ≥2 x baseline level	**Consider clinical review ≤ 24 hours of e-alert*** **If AKI confirmed** → manage as per table 2	**Consider clinical review ≤ 6 hours of e-alert*** **Likely Stage 2 AKI** → manage as per table 2
AKI Warning Stage 3 Current creatinine ≥3 x baseline level (or creatinine 1.5 x baseline and >354 mol/L)	**Consider clinical review ≤ 6 hours of e-alert*** **If AKI confirmed** → consider admission	**Consider Immediate Admission*** Likely Stage 3 AKI

#Clinical Context

Why was the blood test taken?

- Routine chronic disease monitoring
- Drug monitoring
- Assessment of acute illness

Creatinine rise within stable clinical context may reflect unstable CKD instead of AKI, especially if longer time period between current and baseline creatinine.

***AKI Risk Factors/Clinical Features Prompting Earlier Review**

- Poor oral intake/urine output
- Evidence of hyperkalaemia, especially if moderate(K+ 6.0-6.4) or severe (K+ ≥ 6.5)¥
- Known history of CKD stages 4 & 5 or history of kidney transplant
- Deficient Immunity
- Frail with co-morbidities (CKD, diabetes, heart failure, liver disease, neurological or cognitive impairment)
- Past history of AKI
- Suspected intrinsic kidney disease
- Suspected urinary tract obstruction

¥ UK Renal Association Clinical Practice Guidelines (2014) recommends emergency assessment and treatment of severe hyperkalaemia (K+≥6.5mmol/l) – click here

Refer to main guidance document – Responding to AKI Warning Stage Test Results for Adults in Primary Care

The table is a guide to support an initial response to an AKI Warning Stage Test Result but clinical judgement must prevail.
The table does not apply to children and young people (<18 years) or patients receiving end of life care.

Table 2: Recognising and Responding to Acute Kidney Injury for Adults in Primary Care*

"Think" Cause	"Think" Medication#	"Think" Fluids	"Think" Review¥
History of acute Illness? • Think Sepsis • Think Hypotension Intrinsic kidney disease? (E.g. vasculitis) • Think Urinalysis Urinary tract obstruction?	Any medication which could **exacerbate** AKI? Consider withholding: • NSAIDs • Diuretics • Antihypertensive medication Any medication which may **accumulate** and cause harm during AKI? Any **new** medication that may **cause** AKI?(E.g. drug induced tubulo-interstitial nephritis)	What is the patient's volume status? If hypovolemia present: • When did patient last pass urine? • Can the patient increase fluid intake? • Is admission for IV fluid replacement and monitoring required? Does the patient have and/or need carer support?	Does the patient need acute admission? If not, when will you review? Have you ensured handover?¥

*Refer to main guidance document – Responding to AKI Warning Stage Test Results in Primary Care

Refer to medicines optimisation toolkit for primary care http://www.thinkkidneys.nhs.uk/aki/medicines-optimisation-for-aki

¥ Refer to overarching principles in communication of diagnostic test results https://www.england.nhs.uk/patientsafety/discharge

The table is a guide to support recognition and response to AKI in primary care
The table does not apply to children and young people (<18 years) or patients receiving end of life care

Acute Kidney Injury - Potentially Problematic Drugs and Actions to Take in Primary Care

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	Effects on renal/fluid/electrolyte physiology	Change in the side effect profile when renal function is reduced	Direct action on the kidneys	Action in presence of AKI
NSAIDs / COX II inhibitors	Altered haemodynamics within the kidney leading to underperfusion and reduced glomerular filtration		Acute interstitial nephritis (rare)	Avoid
Opioid analgesics		Accumulation of active metabolites in AKI (especially morphine, pethidine and codeine) – increased incidence of CNS side effects & respiratory depression		Avoid long acting preparations. Reduce dose and frequency Use opiates with minimal renal excretion e.g. fentanyl, oxycodone, hydromorphone, tramadol
Aciclovir		Drug accumulates in reduced renal function leading to mental confusion, seizures	Crystal nephropathy Acute interstitial nephritis (rare)	Reduce dose Encourage patient to drink plenty Beware if patient is at risk of dehydration
Co-trimoxazole (see also trimethoprim)	Hyperkalaemia (see Trimethoprim)		Crystal nephropathy Acute interstitial nephritis (rare)	Reduce dose Encourage patient to drink plenty Beware if patient is at risk of dehydration
Trimethoprim	Increased risk of hyperkalaemia (especially in combination with spironolactone or ACEI/ARB) Interferes with tubular secretion of creatinine leading to a rise in serum creatinine without a true change in GFR	Accumulation increases risk of hyperkalaemia (particularly with high doses), nausea and vomiting	Acute interstitial nephritis (rare)	Avoid or reduce dose (particularly if patient is already taking an ACEI, ARB or spironolactone)
Phenytoin		Risk of phenytoin toxicity if patient has low serum albumin levels	Acute interstitial nephritis (rare)	Monitor levels Correct phenytoin levels for uraemia and low serum albumin or measure salivary phenytoin (if assay available)
Pregabalin & Gabapentin		Accumulation leading to increase in CNS side effects		Reduce dose
Antihypertensives (including Ca-channel blockers, α-blockers, β-blockers, etc)	Hypotension may exacerbate renal hypo-perfusion	Risk of bradycardia increased with Beta Blockers	Many may have rare specific effects upon the kidneys resulting in AKI	Consider withholding / reduce dose depending on clinical signs

Acute Kidney Injury - Potentially Problematic Drugs and Actions to Take in Primary Care

	Effects on renal/fluid/electrolyte physiology	Change in the side effect profile when renal function is reduced	Direct action on the kidneys	Action in presence of AKI
ACEI / ARBs / Aliskiren	Hypotension Hyperkalaemia			In some situations, e.g. heart failure continuing them might actually be helpful Consider alternative antihypertensive agents
Thiazide & Loop Diuretics	Volume depletion	Loop diuretics (furosemide & bumetanide) preferred as thiazides less effective if GFR < 25ml/min. However thiazides can potentiate the effects of loop diuretics	Acute interstitial nephritis (rare)	Monitor and adjust dose as necessary
Hypoglycaemic Drugs		Accumulation in AKI may increase risk of hypoglycaemia		Avoid long acting preparations. Monitor blood glucose levels & reduce dose if necessary
Metformin		Risk of lactic acidosis increased Accumulation leading to hypoglycaemia		Avoid if GFR < 30 ml/min Seek nephrologist advice if undergoing contrast procedure or at risk of AKI
Colchicine		Diarrhoea / vomiting causing hypovolaemia		Low doses e.g. 500mcg bd or tds are effective or consider steroids. Do not use NSAIDs for gout
Digoxin	Hyperkalaemia	May accumulate in AKI leading to bradycardia, visual disturbances, mental confusion		Reduce dose Monitor drug level
Lipid-lowering agents e.g. fibrates, statins		Increased risk of rhabdomyolysis		Stop if AKI due to rhabdomyolysis. Otherwise, continue therapy but monitor. Stop if patient develops unexplained / persistent muscle pain
Lithium	Can cause nephrogenic diabetes insipidus Very rarely it is associated with neuroleptic malignant syndrome.	Accumulation increases risk of side effects Kidney impairment exacerbated in hypovolaemia and in combination with ACE inhibitors / ARB / NSAIDs		Avoid where possible Monitor lithium levels Encourage patient to drink plenty. Monitor electrolytes

This table has been produced as a quick reference – fuller information about Medicines Optimisation in Patients with AKI is on the Think Kidneys website here
For more information on AKI and for resources on its prevention, detection, treatment and management created specifically for primary care visit
https://www.thinkkidneys.nhs.uk/aki/resources/primary-care

Think Kidneys is a national programme from the UK Renal Registry in partnership with NHS England - April 2016

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April 2016

When or if to re-start ACEI, ARB, diuretics and other antihypertensive drugs after an episode of Acute Kidney Injury

During acute illness, particularly involving sepsis, hypovolaemia or hypotension, renal blood flow is often reduced, resulting in Acute Kidney Injury (AKI). Clinicians managing patients with AKI therefore frequently stop drugs that lower blood pressure (particularly ACEI and ARBs, which selectively reduce glomerular pressure) and diuretics. ACEIs, ARBs and potassium-sparing diuretics may also be stopped because of hyperkalaemia. This document gives guidance on when these drugs should be re-started after an episode of AKI.

1. The original indication for the use of the drug should be reviewed.

2. If a specific contraindication to the use of an ARB/ACEI has been identified (e.g. severe bilateral renal artery stenosis), an alternative drug should be used.

3. For patients previously stabilized on drugs for the treatment of heart failure, these drugs should be re-started as soon as clinically reasonable, and re-titrated to achieve the best control of fluid balance and blood pressure, unless there is a specific contraindication. These medicines will often be recommenced in the hospital setting before discharge but will require titration in the community to get an optimal effect. In general, if the patient is under the continuing care of a specialist heart failure service, then that service should be involved in this drug titration; otherwise, the GP can take responsibility.

4. Follow existing guidelines to identify high-risk patients whose ACEI or ARB should be re-started in secondary care.

5. Patients previously stabilized on ACEI or ARB for chronic kidney disease with albuminuria (diabetes with albumin:creatinine ratio > 3 mg/mmol; hypertension with albumin:creatinine ratio >30 mg/mmol; albumin:creatinine ratio > 70 mg/mmol irrespective of hypertension or cardiovascular disease) should be re-started on these drugs unless there is a new contra-indication, for instance pre-treatment serum potassium > 5 mmol/L (NICE CG182).

6. For patients previously stabilized on drugs for the treatment of essential hypertension, the episode of AKI should prompt review of the antihypertensive strategy. All patients should attend their GP's surgery for review within 6 weeks of discharge. Blood pressure should be re-checked, ideally with home or ambulatory blood pressure monitoring, to inform decisions about whether resumption of antihypertensive therapy is required.

    a. For patients previously stabilized on a single BP-lowering drug, therapy should be brought into line with NICE/BHS guidance CG127 as applied to patients being started on BP-lowering treatment:

        i. Patients over the age of 55 and black people of African or Afro-Caribbean family origin should be offered a calcium channel blocker as first line treatment, even if they were previously stabilized on an ACEI or ARB.

        ii. All other patients previously on an ACEI or ARB for hypertension should be re-started on their original drug treatment unless they have serum potassium > 5 mmol;/l, or are at risk of recurrent hypovolaemia (e.g. high volume ileostomy) in which case alternatives should be considered. Serum creatinine and potassium should be re-measured 1-2 weeks after re-starting and any subsequent dose titration, as for use in other settings.

    b. If a patient is left off treatment (for instance, if clinic BP is <140/90 or home BP <130/85), further follow-up should be offered for at least 12 months, as it may take some time for blood pressure to return to previous levels after recovery from acute illness.

7. All of the above should be applied in a holistic manner, taking into account the overall functional status of the patient. As in other settings, patients and carers should be involved in decisions about drug treatment and given the best available information about the risks and benefits of each option.

For more information on AKI and for resources on its prevention, detection, treatment and management created specifically for primary care visit https://www.thinkkidneys.nhs.uk/aki/resources/primary-care

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