SPOTTING THE SIGNS OF ACUTE KIDNEY INJURY

With 65% of cases beginning in the community, pharmacists can help detect acute kidney injury early and review patients' medicines before their condition worsens.

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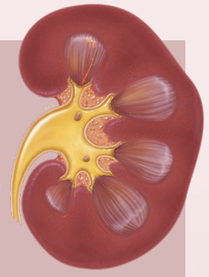
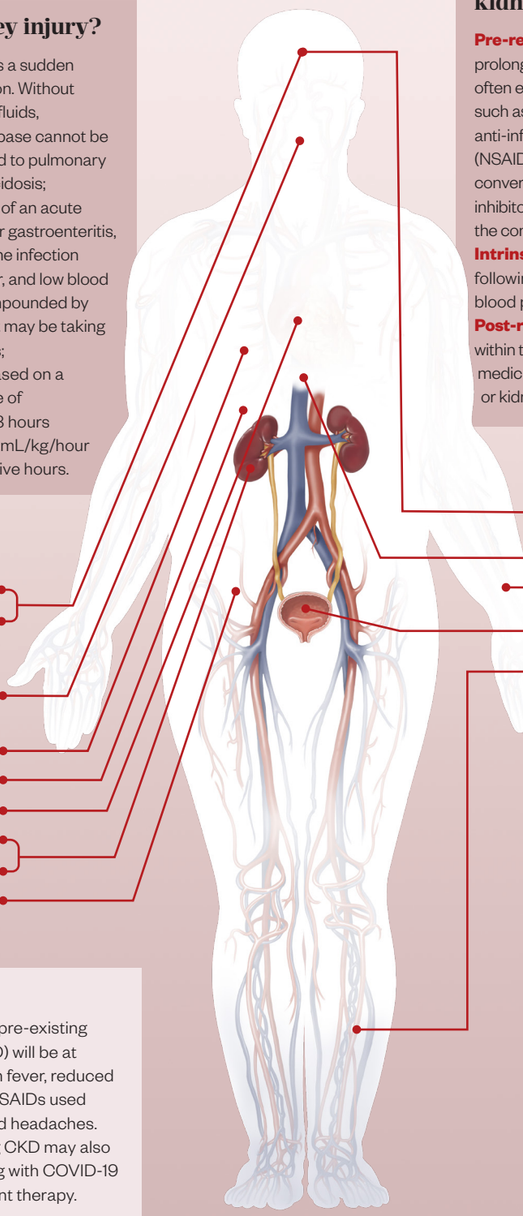
What is acute kidney injury?

- Acute kidney injury (AKI) is a sudden reduction in kidney function. Without treatment, the balance of fluids, electrolytes and the acid-base cannot be maintained, which can lead to pulmonary oedema and metabolic acidosis;
- AKI mostly occurs as part of an acute illness, such as influenza or gastroenteritis, owing to several factors: the infection itself, loss of salt and water, and low blood pressure. This can be compounded by medicines that the patient may be taking for this or other conditions;
- The diagnosis of AKI is based on a serum creatinine increase of 26.5 micromol/L within 48 hours and a urine output of <0.5mL/kg/hour for more than 6 consecutive hours.

Causes of acute kidney injury:



Pre-renal AKI is caused by a prolonged fall in blood pressure, often exacerbated by medicines, such as non-steroidal anti-inflammatory drugs (NSAIDs), angiotensin-converting enzyme (ACE) inhibitors or angiotensin II receptor blockers (ARBs), in the context of acute or serious illness;
Intrinsic AKI is caused by damage to the kidney following use of certain medicines, a sustained drop in blood pressure, or as a result of kidney disease.
Post-renal AKI is caused by obstruction of urinary flow within the renal tract (e.g. owing to enlarged prostate, medicines that precipitate insoluble crystals or kidney stones).



Risk factors

- Aged 65 years or older
- Neurological or cognitive impairment (reliance on a carer for fluids)
- Taking medicines with nephrotoxic potential
- Cancer
- Liver disease
- Heart failure
- Chronic kidney disease
- History of AKI
- Diabetes

Symptoms

- Tiredness
- Confusion
- Nausea
- Itchy skin
- Reduced urine output
- Dark urine
- Swelling in the legs or feet

COVID-19

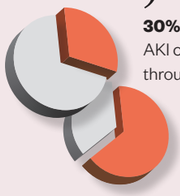
Patients with COVID-19 and pre-existing chronic kidney disease (CKD) will be at increased risk of AKI through fever, reduced fluid intake, diarrhoea, and NSAIDs used for treatment of myalgias and headaches. Patients without pre-existing CKD may also develop AKI when presenting with COVID-19 and require renal replacement therapy.

Impact of acute kidney injury

1 in 5 unplanned hospital admissions are a result of AKI

DEATHS PER YEAR:

100,000



30% of deaths from AKI could be prevented through interventions

65% of AKI cases begin in the community

Structure of the nephron and medicines that should be reviewed or stopped

1 Afferent arteriole
Blood enters the nephron in the afferent arteriole

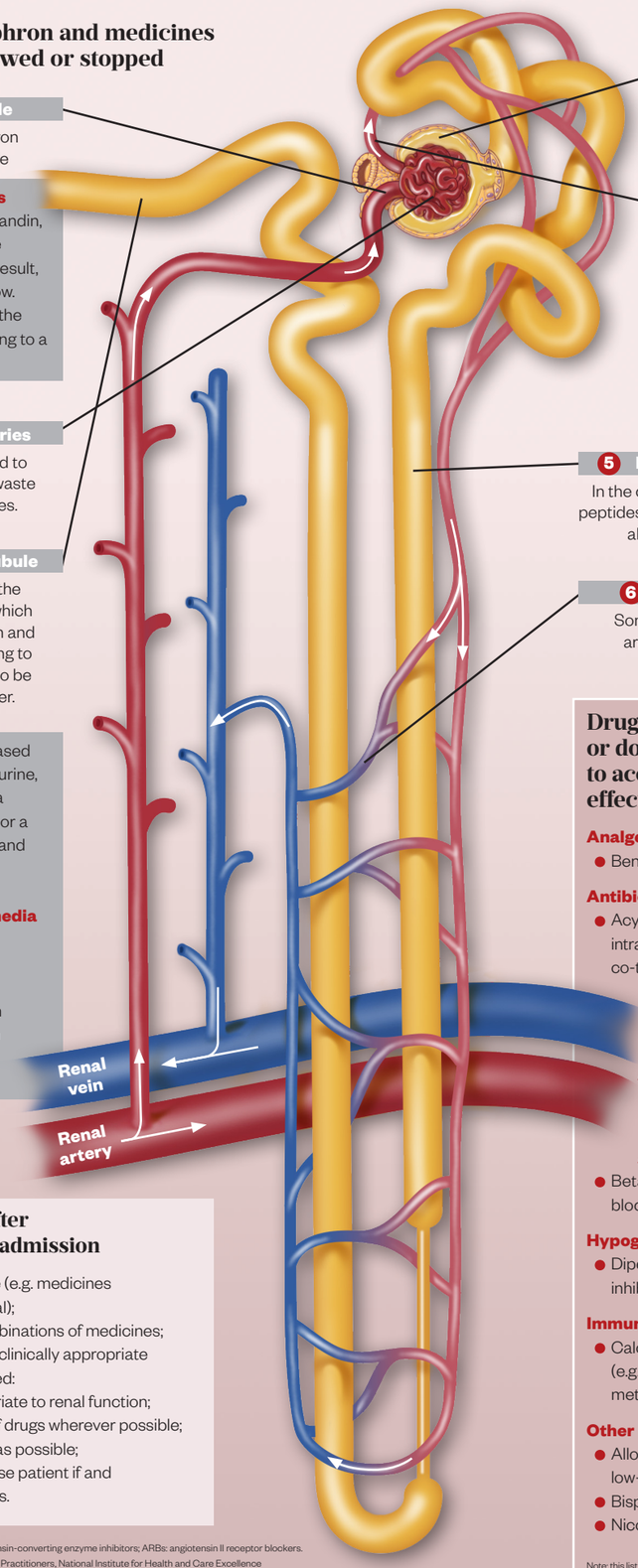
NSAIDs/COX-II inhibitors inhibit synthesis of prostaglandin, which causes dilation of the afferent arteriole and, as a result, the afferent arterioles narrow. This lowers the pressure in the glomerular capillaries, leading to a reduced filtration rate.

2 Glomerular capillaries
Small veins filter the blood to remove water, metabolic waste products and electrolytes.

7 Distal convoluted tubule
The filtrate moves on to the distal convoluted tubule, which reabsorbs calcium, sodium and chloride, before progressing to the collecting duct ready to be funnelled into the bladder.

Diuretics can cause increased or excessive production of urine, exacerbating hypovolaemia (loss of both salt and water or a decrease in blood volume) and reducing renal blood flow.

Iodine-based contrast media causes contrast-induced nephropathy which is associated with a sharp decrease in kidney function (indicated by an increase in serum creatinine) over a period of 48–72 hours.



3 Bowman's capsule
The filtrate then passes through a cup-shaped capsule into the proximal convoluted tubule.

4 Efferent arteriole
After filtration, blood exits via the efferent arteriole.

ACE inhibitors and ARBs cause widening of the efferent arteriole, which slows the flow of blood and reduces the glomerular filtration rate.

5 Proximal convoluted tubule
In the convoluted tubule, glucose, water, peptides and other nutrients are selectively absorbed back into the blood.

6 Peritubular capillaries
Some medicines and electrolytes are secreted by the peritubular capillaries into the filtrate.

Medicines review after acute kidney injury admission

- Eliminate potential cause (e.g. medicines with nephrotoxic potential);
- Avoid inappropriate combinations of medicines;
- Ensure all medicines are clinically appropriate
- If a medicine must be used:
  - Amend doses appropriate to renal function;
  - Monitor blood levels of drugs wherever possible;
  - Keep course as short as possible;
- Following discharge, advise patient if and when to restart medicines.

Drugs that need monitoring or dose adjustment owing to accumulation or other effects on the kidneys

Analgesics
- Benzodiazepines, opioids, tramadol

Antibiotics/antifungals/antivirals
- Acyclovir, aminoglycosides, intravenous (IV) amphotericin, co-trimoxazole fluconazole, ganciclovir IV, penicillin, teicoplanin, tetracycline, trimethoprim, valganciclovir, vancomycin

Antiepileptics
- Levetiracetam, pregabalin and gabapentin

Antihypertensives
- Beta blockers, calcium-channel blockers, thiazide and loop diuretics

Hypoglycaemics
- Dipeptidyl peptidase-4 inhibitors, metformin

Immunosuppressants
- Calcineurin inhibitors (e.g. ciclosporin, tacrolimus), methotrexate

Other
- Allopurinol, digoxin, lithium, low-molecular-weight heparins
- Bisphosphonates
- Nicorandil, nitrates

Note: this list is not exhaustive and is only intended to act as an *aide-memoire* to the medicines optimisation of patients with AKI

COX-II: cyclooxygenase-2; ACE inhibitors: angiotensin-converting enzyme inhibitors; ARBs: angiotensin II receptor blockers.
Sources: Think Kidneys, Royal College of General Practitioners, National Institute for Health and Care Excellence
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