University Hospitals of Liverpool Group

Acute Kidney Injury Manual
(Adapted form North West Kidney network AKI manual)

LUHFT Document

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Latest Version	Page	Changes Made	Date
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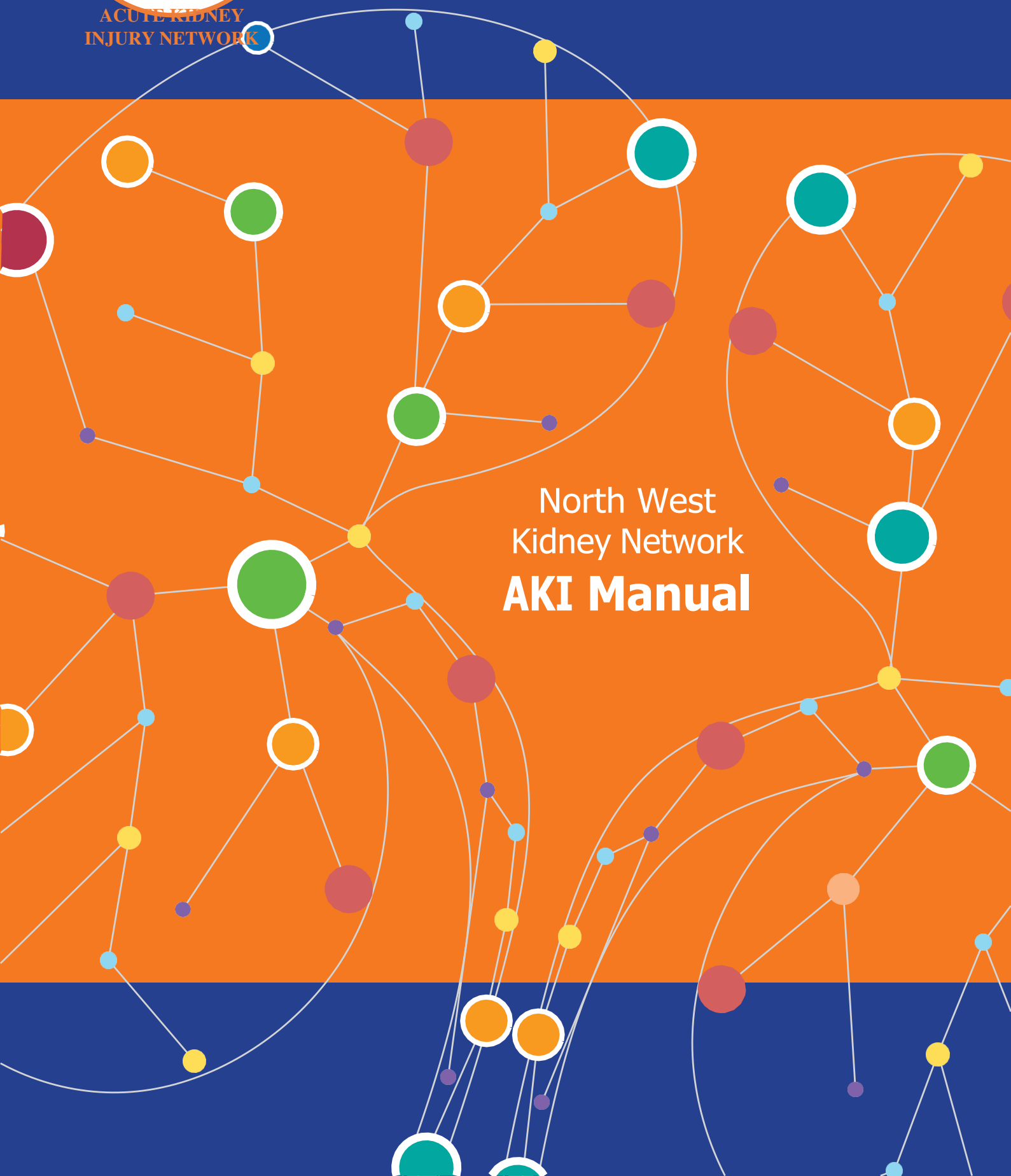
NORTH WEST KIDNEY NETWORK

ACUTE KIDNEY INJURY NETWORK



North West Kidney Network

AKI Manual

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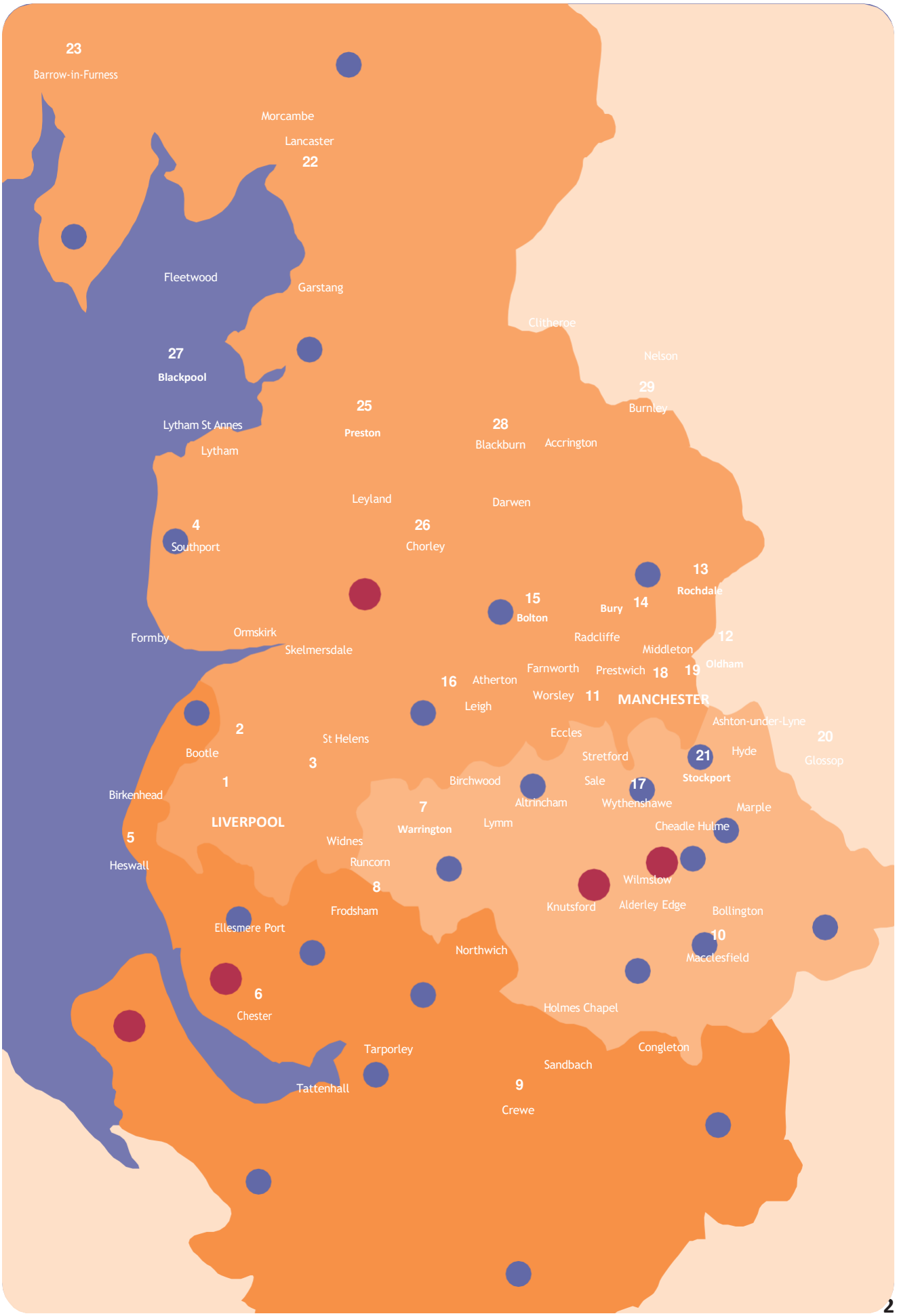
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NWKN AKI hospital locations

Cheshire & Mersey

Liverpool University Hospitals NHS Foundation Trust

1. Royal Liverpool University Hospital
2. Aintree University Hospital

Mersey and West Lancashire Teaching Hospitals NHS Trust

3. Whiston Hospital
4. Southport and Formby Hospital

5. Arrowe Park Hospital

6. Countess of Chester Hospital NHS Foundation Trust

Warrington and Halton Hospitals NHS Trust

7. Warrington Hospital
8. Halton Hospital

9. Leighton Hospital

10. Macclesfield District General Hospital

Greater Manchester

Northern Care Alliance NHS Foundation Trust

11. Salford Royal Hospital
12. Royal Oldham Hospital
13. Rochdale Infirmary Hospital
14. Fairfield General Hospital

15. Royal Bolton NHS Foundation Trust

16. Royal Albert Edward Infirmary

Manchester University NHS Foundation Trust

17. Northern Manchester General Hospital
18. Manchester Royal Infirmary
19. Wythenshawe Hospital

20. Tameside and Glossop Integrated Care NHS Foundation Trust

21. Stepping Hill Hospital

Lancashire and South Cumbria

University Hospitals Morecambe Bay NHS Foundation Trust

22. Royal Lancaster Infirmary
23. Furness General Hospital
24. Westmorland General Hospital

Lancashire Teaching Hospital NHS Foundation Trust

25. Royal Preston Hospital
26. Chorley and South Ribble Hospital

27. Blackpool Victoria Hospital

East Lancashire Hospitals NHS Trust

28. Royal Blackburn Teaching Hospital
29. Burnley General Teaching Hospital

1. Summary

Acute Kidney Injury (AKI) continues to remain common and represent a significant cause of morbidity and mortality. AKI has proved a valuable means of identifying the deteriorating patient, in whom dealing with the underlying disease is also an integral part of treating the AKI.

This document is intended as an aid for the detection and management of acute kidney injury in both the hospital and community settings. This document excludes the paediatric population. It aims to support clinicians regardless of their experience, across different healthcare settings to deal with AKI and thereby improve their patients' outcomes.

This document has been developed from the Cheshire and Mersey AKI Network Manual and has been updated based on available evidence at the time of writing, with any alternate practice according to physician discretion.

The interpretation and application of clinical guidelines will remain the responsibility of the individual clinician. When there is any uncertainty regarding the most appropriate clinical plan, early discussion with the nephrology or critical care teams is recommended.

2. Purpose

This document is to help guide recognition and management of acute kidney injury.

3. Scope

This document is intended for use by:

- Medical staff
- Nursing staff

4. Guideline

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There are no conflicts of interest to declare

Risk assessment to prevent AKI

Risk factors

- Hypovolaemia
- Heart failure
- Liver disease
- Deteriorating NEWS
- Diabetes
- History of AKI
- Oliguria
- Renal transplant
- Age ≥ 65
- Sepsis
- Chronic kidney disease
- New onset or significant worsening of urological symptoms
- Medicines of nephrotoxic potential
- Neurological or cognitive impairment that limits access to fluids
- Symptoms suggesting complications of AKI
- Recent Intraperitoneal surgery

If ANY risk factor present –

1. Measure Urea, Creatinine and electrolytes (U&E).
2. Perform medication review.
3. Commence regular monitoring of National Early Warning Scores (NEWS) & urine output.
4. Maintain adequate hydration and BP.

NWKN Acute Kidney Injury (AKI) Care Bundle

(Based on NICE AKI Quality Standards 2023)

	AKI Care Bundle	Completed (yes/no)
F	**Fluid** • Fluid assessment (Intake /output chart). • IV fluid prescribe where necessary.	
L	**Low BP** • Suspend/reduce anti-hypertensive. • RAS inhibitor[1] (i.e., ramipril, losartan group) – Suspend if low BP or, hyperkalaemia.	
U	**Urine** • Monitor urine output. • Urine Dip test (urgent renal screen if haematoproteinuria[2]).	
I	**Imaging** • Bladder scan if suspected urinary retention. • Urgent renal ultrasound scan if concerns of upper urinary tract. obstruction or, bladder scan positive[3].	
D	**Drugs (nephro- sensitive medication review[1])** • NSAID – suspend. • Diuretics: dose adjustment/suspend if hypovolaemic. • Dose Review (examples – metformin, opiates, anti-epileptic, amitriptyline, gabapentin, anti-coagulants).	
S	**Sepsis (Diagnose & Rx underlying cause[4])** • If sepsis – start antibiotic immediately (sepsis 6 bundle).	
24	**Reassess 24 hours** • Repeat Renal function.	

AKI Renal Referral:	Action Point
• Oliguric progressive AKI not responding to Rx or, who may require dialysis[5]. • Suspected vasculitis/ glomerulonephritis (Intrinsic renal pathology).	
AKI at Discharge to GP:	
• AKI diagnosis with FU plan[6]. • AKI patient information leaflet.	

AKI : Think 'Fluids24'

(**F** = fluid therapy; **L** = low BP, suspend antihypertensive; **U** = urine output and dip test, I = renal imaging/ultrasound; **D** = drugs/medication review, **S** = sepsis/Rx underlying cause; reassess and repeat renal function in 24 hour)

[1]**Medication Review:** RAS inhibitor (Renin Angiotensin system Inhibitor - consider dose reduction by 50% with progressive AKI.) Metformin - review/suspend with stage 2&3 AKI. Diuretic: Dose adjustment. STOP NSAID. Review antibiotic or, anticoagulant dose.

[2]**Urine Dip test** - Urgent Renal screen if macrohematuria/proteinuria on urine dip test (ANCA, Anti GBM Ab, serum Electrophoresis, Serum free light chain ratio, urine ACR).

[3]**Renal Ultrasound scan/CT KUB Imaging** - if suspected obstruction or, unexplained/progressive AKI.

[4]**Renal referral** i.e., Oliguric stage 3 AKI if dialysis indicated. AKI with severe metabolic acidosis or, Resistant hyperkalaemia* (Consider ICU team referral if hypotensive multi organ failure or, severe acidosis with PH < 7.2)

[5]**Any medication stopped**, must have a review and where possible, plan to restart with advice before discharge.

Alternative bundle for audit purposes

Example 2: A simpler version of AKI care bundle (core elements: can be used for audit purpose)

	AKI Care Bundle	Completed (yes/no)
1.	**Fluid** • Fluid assessment (Intake /output chart). • IV fluid prescribe where necessary.	
2.	**Medication Review**[1] • Low BP – suspend / reduce anti-hypertensive. • RAS inhibitor (i.e., ramipril, losartan group) – Suspend if low BP or, hyperkalaemia. • Dose Review (diuretics, metformin, opiates, anti-epileptic, amitriptyline, gabapentin, anti-coagulants). • Suspend NSAID.	
3.	**Diagnose & Treat underlying cause**[5] (i.e., sepsis, fluid depletion, urinary obstruction or, intrinsic renal disease) • If sepsis – start antibiotic (sepsis 6 bundle).	
4.	**Urine** • Monitor urine output. • Urine Dip test (urgent renal screen if haematoproteinuria[2]).	
5.	**Imaging** • Bladder scan if suspected urinary retention. • Urgent renal ultrasound scan if concerns of upper urinary tract. obstruction or, bladder scan positive[3].	
6.	**Reassess 24 hours** • Repeat Renal function	

AKI Renal Referral:	Action Point
• Oliguric progressive AKI not responding to Rx or, who may require dialysis[4]. • Suspected vasculitis/ glomerulonephritis (Intrinsic renal pathology).	
AKI at Discharge to GP:	
• AKI diagnosis with FU plan[5]. • AKI patient information leaflet.	

NICE 2023 Recommendation: All stage 2 & 3 AKI should have clinical review/ AKI care bundle started within 6 hours of diagnosis. (AKI audit tool: 1-3 steps within 6 hours; 4-6 steps within 24 hours)

[1]**Medication Review:** RAS inhibitor (Renin Angiotensin system Inhibitor - consider dose reduction by 50% with progressive AKI.) Metformin - review/suspend with stage 2&3 AKI. Diuretic: Dose adjustment. STOP NSAID. Review antibiotic or, anticoagulant dose.

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[5]**Any medication stopped**, must have a review and where possible, plan to restart with advice before discharge.

Diagnosis of AKI

Confirm diagnosis using the following criteria:

- **Serum creatinine rise ≥ 1.5 fold from the reference value within one week (known/ presumed).**

OR

- **Urine output is < 0.5ml/kg/hr for > 6 consecutive hours.**

Please note – The reference serum creatinine should be the lowest creatinine value recorded within 3 months of the event. If a reference serum creatinine value is not available within 3 months and AKI is suspected repeat serum creatinine within 24 hours.

After AKI is recognised, initiate investigations and management as soon as possible.

AKI Stage	Serum creatinine criteria	Urine output criteria
1	Serum Creatinine increase of 1.5 – 1.9 times baseline	< 0.5 ml/kg/hr > 6 consecutive hrs
2	Serum Creatinine increase 2 – 2.9 times baseline	< 0.5 ml/kg/hr > 12 consecutive hrs
3	Serum Creatinine increase ≥3 times baseline or ≥354 µmol/L or commenced on renal replacement therapy (RRT)	< 0.3 ml/kg/hr > 24 consecutive hrs or anuria for 12 hrs

Investigations

- FBC, U&E, CK if indicated, bone profile, LFT, coagulation, CRP, serum bicarbonate/VBG, CXR if indicated, ECG. Please perform blood film if history of diarrhoea or suspicion of haemolysis.
- Urine dipstick (blood and protein suggestive of intrinsic disease), urine C&S, urine ACR and/or PCR.
- Urgent renal screen in all patients with blood & protein in urine pre-catheterisation and consider in AKI stage 3 where clinical or lab features suggest intrinsic disease: ANCA, Anti GBM, ANA, dsDNA, C3/C4, HIV, hepatitis B and C, serum immunoglobulins and electrophoresis, serum free light chains, urine electrophoresis/bence jones protein.
- Daily U&E and venous bicarbonate on laboratory sample until AKI resolved.
- Bladder scan if bladder palpable or suspicion of lower urinary tract obstruction.
- Ultrasound KUB/CT KUB within 24 hours if upper urinary tract obstruction suspected/cause of AKI unknown/AKI not resolving. Perform within 6 hours if suspicion of infected kidney (pyonephrosis)/obstructed single kidney.

Management

IDENTIFY & TREAT CAUSE: causes include hypoperfusion, obstruction, sepsis, intrinsic kidney disease, rhabdomyolysis, toxins, trauma/surgery, liver decompensation. If unknown, document as unknown.

BP and hydration

- If BP low and/or volume deplete – stop antihypertensives and diuretics, give IV fluids dependent on volume status, commence input output chart and hourly NEWS. If IV fluid indicated not hyperkalaemic and/or hypovolaemic hyponatraemic, balanced crystalloid (e.g Hartmanns or plasmalyte) would be IV fluid of choice. Consider continuing ACEi/ARB if decompensated cardiorenal syndrome unless AKI stage 2 or 3, and then review the need to suspend. Continue SGLT2i in decompensated cardiorenal syndrome. See **Heart failure and AKI management**.

Medications

- ACE/ARB-advice as above.
- Diuretics - Stop diuretics if hypovolaemic. Can consider starting diuretics if volume overloaded and passing urine with input from specialist team if indicated.
- Avoid use of NSAIDS. Consider dose reduction of opiates and neuropathic agents. Convert morphine to oxycodone if eGFR<30. If used, ensure appropriate dosing and monitoring of gentamicin as per local hospital policy. Stop metformin and appropriate dose adjustment of LMWH if eGFR<30.
- Perform medication review within 24 hours.

Assess for symptoms & signs of infection with appropriate management if present
Catheterise if in urinary retention /lower urinary tract obstruction or sustained hypotension.

Complications

Identify and treat complications:

- **Hyperkalaemia** – please refer to Renal Association **UKKA Clinical Practice guidelines: treatment of acute hyperkalaemia** (see page 167).
- **Pulmonary oedema** – full history and examination including ABCDE assessment. Sit up and administer oxygen to target sats or high flow if acutely unwell. Depending on volume assessment and blood pressure, administer appropriate dose of IV furosemide. If clinical concern or uncertainty, ensure immediate senior review. If oligoanuric and AKI stage 3 please refer urgently to nephrology and escalation to local ICU if appropriate.
- **Metabolic acidosis** – please assess the patient after resuscitation with IV crystalloid fluids, as this alone may reverse metabolic acidosis in cases of simple pre-renal AKI, (even stage 3 AKI). However, if there is no improvement, or any concerns, please consult the on-call Nephrology or Intensive Care team. The Nephrology team may recommend initiating oral sodium bicarbonate replacement and adjusted according to response, or stop before discharge when the AKI improves. In cases of severe metabolic acidosis the Nephrology team may consider prescribing intravenous sodium bicarbonate 500ml at a concentration of 1.26% or 1.4% at a rate as per bedside clinical assessment.

Referral advice

All patients with AKI should have a senior review within 12 hours. Referrals should be made according to the advice below unless it has been decided that the particular escalation strategy is not appropriate after senior review and this is documented in the notes.

Critical care outreach:

- All patients with AKI meeting local referral criteria for critical care outreach. This does not replace renal referral guidelines details below.

Renal/AKI team:

- If in renal centre, refer immediately if indication for renal replacement therapy (see below).
- AKI stage 3: If not responding to initial therapy or oliguric.
- AKI stage 1 or 2: complications or progression despite medical management.
- Suspicion of intrinsic renal disease.
- Nephrotic syndrome (urine PCR or uACR>300 , serum albumin <30 and peripheral oedema).
- All patients with renal transplant infection and/or AKI.

Critical Care:

- Respiratory failure (pulmonary oedema) or circulatory failure requiring inotropes.
- Multi-organ failure.
- Severe acidosis (pH <7.2).
- Patients not responding to medical management or who may need dialysis /haemofiltration in centre without on-site renal team.
- Referral should also be made where the AKI transfer checklist suggests requirement due to criteria that would make transfer to renal hub potentially unsafe (see page 12).

Urology:

- Renal tract obstruction with urgent urology review if evidence of pyonephrosis, solitary obstructed kidney, bilateral obstruction or complications of AKI secondary to urological obstruction. Urgent nephrostomies should be placed within 12hrs where indicated.

Indications for renal replacement therapy

The common indications that trigger consideration of RRT for AKI are:

1. Pulmonary oedema not responding to medical treatment.
2. Hyperkalaemia not responding to appropriate medical treatment.
3. Severe acidosis not responding to medical treatment.
4. Uraemic encephalopathy.
5. Uraemic pericarditis.
6. Drug ingestion/accumulation as guided by TOXBASE.

RRT options should be discussed with all suitable patients by the parent team in conjunction with the nephrologist/ intensivist when and if required. Decisions on whether a patient is suitable or not are usually based on factors including pre-existing comorbidities and baseline functional status, and overall prognosis.

Acute Kidney Injury Transfer Checklist

The below transfer criteria must be met to allow safe transfer to the renal hub. These criteria should be met at the time of transfer, and not just time of referral. Transfer should occur within 24 hours of accepting patient for transfer.

If the below criteria are not met, please refer to critical care and/or discuss with accepting on call renal consultant.

Please ensure the below clinical assessment of transfer safety is made by registrar or consultant. Choice of staff to accompany patient is for local senior judgement. If in doubt, critical care review in the referring hospital should be requested to offer an opinion on how the transfer should proceed. Please inform receiving renal hub of infection control status of the patient.

Essential Criteria

Airway	Airway patent and safe without adjuncts
Breathing	Respiratory rate >9/min and <25/min. Adequate oxygenation and not on more than 35% oxygen. Not requiring NIV or CPAP within last 24 hours.
Circulation	Heart rate >50/min and <120/min. SBP >100mmHg and MAP of > 65mmHg. Stable off inotropic support for at least 24 hours. No request for blood products in last 4 hours. No life-threatening haemorrhage in last 24 hours. No CPR in last 24 hours.
Disability	AVPU – alert. Discuss any new or background cognitive impairment on referral. CBG >4 (if patient has received insulin/dextrose please ensure blood sugar is checked at 15 minutes, 30 minutes and then hourly).
Metabolic	Potassium ≤ 6.4mmol/l with no ECG changes. pH >7.2 (not at risk of respiratory decompensation with respiratory rate>25) Normal lactate.

There is physician discretion with this guideline – please discuss with on call renal consultant.

Obstetric AKI

The renal team advocate a patient with pre-existing renal disease, ie CKD, hereditary renal disease, glomerulonephritis or abnormal urine dip should have routine checking of U&E as part of the booking bloods.In the event of any unplanned admission during pregnancy U&E should be checked as part of admission bloods.

Recognition

AKI can be diagnosed with:

- Creatinine >77umol OR > 1.5x baseline creatinine.
- Urine output <0.5ml/kg/hour for more than 6 hours.

THIS IS POTENTIALLY A MEDICAL EMERGENCY

Action: Full set of observations, history and examination. Assess for signs of shock and hypoperfusion. Consider investigations for pre-eclampsia (defined with onset of oedema, hypertension and proteinuria) in 3rd trimester, although can occur earlier.

Senior review and nephrology referral in all AKI in pregnancy if triggers MEWS or clinical concern.

Ensure urgent review by obstetric team with renal team input as necessary, or if there is uncertainty about volume management.

Causes include

- Pre renal – sepsis, hypovolaemia (postpartum haemorrhage).
- Renal – NSAIDs, pre-eclampsia, HELLP, HUS, TTP.
- Post renal – obstruction or ureteric damage during delivery.

Investigations

- U&E, VBG, LFTs.
- If hyperkalaemic – follow **UKKA Clinical Practice guidelines: treatment of acute hyperkalaemia** (see page 167).
- Urine dipstick. If proteinuria on urine dipstick – send urgent urine PCR and urine microscopy and culture. Please update obstetric team if proteinuria.
- Renal ultrasound.
- If thrombocytopenia – blood film, LDH, reticulocytes, bilirubin.
- Consider investigations for pre-eclampsia with sFlt/PIGH.

Monitoring

- Regular fluid assessment and observations.
- Catheterise if retention/lower urinary tract obstruction or hypotensive.
- Measure hourly urine output.

Management

- Fluid therapy if hypovolaemic or hypotensive – if there is uncertainty seek obstetric/renal input. Please note, patients with pre-eclampsia can be very sensitive to fluid challenges and are at risk of developing pulmonary oedema requiring high dependency care.
- If sepsis present – follow sepsis six and adequately treat.
- Review drug chart with pharmacist.
- Treat underlying cause (see below).

Referrals

- All cases should be managed in conjunction with obstetrician.
- Refer to critical care if multiorgan failure or hypotension or critically unwell.
- Refer to renal all cases of acute kidney injury in pregnancy. If haematoproteinuria or other suspicion of intrinsic renal disease please refer to renal team.
- Refer to urology for pyonephrosis or urinary obstruction not relieved by catheterisation.
- Please refer any pregnant woman already known to renal services including those with renal transplant and vasculitis/SLE/immune mediated disease.

Wiles, K et al. Serum creatinine in pregnancy: a systematic review. Kidney Int Rep. 2019;4:408-419

Peri-operative AKI management

AKI is a common complication in patients undergoing surgery and it is associated with increased morbidity, mortality and development of CKD.

Individual patient counselling on risks of AKI versus burden on untreated disease/benefit of surgery is up to treating surgeon and patient. Consider referral to nephrology if high risk of AKI or CKD stage 4 or 5. Please also consider suitability of location of operation if considered high risk and may require on site renal support.

Pre-operative measures

- Omit the following medication 48 hours prior to and post surgery- ACEi, ARB, NSAIDS (please see post operative advice below). Seek specialist opinion for resistant hypertension.
- In patients with heart failure and renal impairment, consider omission or dose adjustment of diuretics +/- omission of SGLT2 inhibitor dependent on clinical assessment of fluid status. If there are concerns regarding the risk of overload at the time of assessment, suggest continue use of diuretics and SGLT2i. We suggest a discussion with heart failure team 48-72 hours prior to operation if necessary.

Intra-operative measures

- Avoid intraoperative hypotension.
- Aim MAP > 65mmHg.
- Monitor for blood loss.
- If gentamicin is used for antibiotic prophylaxis, ensure appropriate dosing and monitoring of gentamicin as per local hospital policy if baseline eGFR < 30 mls/min/1.73m^2.

Post-operative measures

- **Consider reintroduction of ACEi/ARB within 48 hours if post-op bloods and BP are satisfactory.**
- Inspect existing urinary catheter to ensure patency.
- Consider bladder scan in patients with post-operative oliguria within first 12 hours.
- Close input and output monitoring.
- Analgesia of choice – Avoid NSAIDS if possible. Use oxycodone if eGFR <30ml/min/1.73m^2.
- Repeat renal function 24-48 hours after operation. If known to heart failure team, please ensure appropriate follow up is in place.

The use of iodinated and gadolinium contrast media in renal impairment

Decision making regarding use of iodinated contrast media (iodinated CM)in patients at risk of AKI should be led by the clinical team responsible for their care. It should be personalised and shared with patients when clinically appropriate. The aim is to minimise delays in iodinate CM use that are likely to be clinically significant, recognising a casual role for iodinated CM in the development of AKI is frequently overestimated. (UKKA AKI National summit report, Dec 2024). Please see LUHFT trust guideline for full details regarding the use of iodinated and gadolinium contrast media in renal

AKI recovery and discharge

AKI recovery

Patients recovering from a significant AKI may develop profound diuresis, which may result in a free water deficit, electrolyte abnormalities and metabolic alkalosis.

During this phase, maintaining euvolaemia and replacing electrolytes if needed are of paramount importance. Accurate fluid balance with daily weights is very important to prevent patients from becoming dehydrated as they recover from AKI. Failure to do so may result in hypovolemic shock and further AKI or life threatening electrolyte imbalances.

AKI discharge

Patients who have had an episode of AKI are at risk of CKD in the long term; this risk depends upon the severity of the episode of AKI. Patients' kidney function should be checked prior to discharge.

Medications should be reviewed prior to discharge, with a plan to reintroduce medications that may have been held during the acute illness, eg. antihypertensives or diuretics, at an appropriate time. This may require an early follow-up with the GP. Medications such as ACEi/ ARB/SGLT2i have important prognostic benefits in renal and cardiac disease and should be reintroduced within 2 weeks.

For patients with a slowly/non-resolving stage 2/3 AKI on discharge, repeat bloods and face to face or virtual review within 2 weeks on local SDEC unit or AKI clinic depending on local provision. Patients already being supported by other community teams such as frailty or heart failure should have ongoing review arranged with these teams. All other cases should be reviewed by GP with bloods within 3-4 weeks alongside community pharmacist review of medications.

It is recommended that the GP discharge letter should include:

1. Cause(s) of AKI.
2. Severity of AKI (state the highest stage during admission).
3. Requirement for critical care admission or renal replacement therapy.
4. Risk factors for AKI.
5. Kidney function on discharge.
6. Advice on whether medications need to be reviewed or reintroduced. This information must be available to the GP at the time of discharge to ensure that patient care is not compromised.

Community Acute Kidney Injury (AKI)

An alert for AKI is generated within the laboratory information management system (LIMS) calculating the creatinine using the NHS England detection algorithm. This identifies **potential** cases of AKI which then requires clinical verification.

Check patient's previous urea, creatinine and electrolyte results (U&E's) to differentiate from stable or progressive chronic kidney disease (CKD) vs AKI.

Use the classification of AKI to assist – see page 9.

Action – Review by GP/community nurse practitioner

Diagnose & treat any acute illnesses contributing to AKI

ESSENTIAL STEPS TO BE INITIATED BY COMMUNITY PHYSICIANS/TEAM

THINK FLUIDS:

Fluid balance: check for signs of dehydration. Encourage oral fluid and assess for need for support for hydration.

Low BP: check BP and if relative hypotension withhold / reduce anti-hypertensive and diuretics (if history of angina/cardiac arrhythmia, consider reducing dose of beta blocker rather than stopping).

Urine: dip test & microscopy. Consider intrinsic kidney disease if protein & blood present in absence of UTI/trauma.

Inspect Bladder: consider possible urinary tract obstruction and arrange for catheter if bladder palpable or confirmation of retention on bladder scan, with onwards urology referral.

Drugs and Toxins: stop NSAIDs. Trimethoprim causes transient increase in creatinine. In the absence of hyperkalaemia, trimethoprim can be continued if eGFR>30 and trimethoprim is indicated. Stop anti-hypertensives including ACEi/ARB if hypotensive. Stop diuretics/SGLT2i if hypovolaemic.

Sepsis: look for signs of sepsis and treat aggressively following sepsis guidelines e.g. UK Sepsis Trust guidance.

Referral

If a patient is acutely unwell with signs of sepsis, or K + is ≥ 6.5, refer urgently to the accident & emergency department unless advance directive states otherwise. If a patient is otherwise stable, but may benefit from IV hydration or has K+ >6 – 6.4, refer urgently to SDEC, unless advance directive states otherwise.

If there is a suspicion of upper urinary tract obstruction arrange for urgent imaging and refer to urology/surgical assessment unit.

If Serum K + is 5.5-5.9 mmol/L and patient is well, stop any oral potassium supplements, NSAIDs, trimethoprim & review medications such as ACE-i, ARBs, MRAs and non-selective beta blockers. Initiate on low K + diet. Recheck serum K+ within 3 days, or as soon as feasible.

Patients with AKI who are initially managed in the community, but have a poor response to treatment, require IV therapy, become oliguric or generally unwell, refer urgently to the accident emergency department, SDEC or nephrology as deemed appropriate, unless advance directive states otherwise

If patient has AKI but is well:

- Continue with essential steps listed above.
- Repeat U&E's in 24 - 48 hours.
- Low potassium dietary advice available at: www.kidneycareuk.org/about-kidney-health/living-kidney-disease/kidney-kitchen/lowering-your-potassium-levels

Recovery

Following recovery of AKI, review medications and before restarting prognostically beneficial agents such as ACEi, ARBs, MRAs and SGLT2i assess the following:

a) Indication for therapy when considering prognostic benefit and future risk of AKI.

b) Volume assessment when reviewing SGLT2i and MRAs.

c) Blood pressure and resolution of any potential infection.

Ensure patient education on AKI, guidance of sick days rules and when to seek medical review. Consider repeat blood tests for U&Es after a further 1-2 weeks.

5. Document Information

References

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Does this document meet the requirements of the Equality Act 2010 in relation to Race, Religion and Belief, Age, Disability, Gender, Sexual Orientation, Gender Identity, Pregnancy & Maternity, Marriage and Civil Partnership, Carers, Human Rights and Social Economic Deprivation discrimination? Yes

Document for Public Display: Yes

Evidence reviewed by NWKN

Heart failure and AKI management

If in decompensated heart failure with fluid overload and AKI

- Appropriate fluid restriction
- Low sodium diet
- Daily weights
- Fluid balance
- Diuretics – commence/increase loop diuretics with continued dose increase to attain an adequate diuresis of 0.5-1L negative balance/day until euvolaemic. If hypokalaemic/potassium is at the lower limit of normal, consider adding an MRA before a further dose increase of loop diuretics. Depending on progress consider the addition of sequential blockade with the addition of a thiazide-like diuretic, MRA and/or acetazolamide.
- SGLT2i should be continued/initiated in patients with decompensated cardiorenal syndrome where not otherwise contraindicated.
- Consider continuing ACEi/ARB if decompensated cardiorenal syndrome where not otherwise contraindicated, unless AKI stage 2 or 3.

The patient requires regular fluid balance assessments, daily weights and daily monitoring of renal function. If a patient becomes hypovolaemic, diuretics should be stopped or withheld temporarily.

If there is uncertainty about the use of diuretics in AKI seek renal input.

If the patients has AKI stage 3 and volume overload not responding to diuretics, or an alternative indication for RRT, please seek urgent renal input.

Glossary of terms and definitions

ACEi Angiotensin-converting enzyme inhibitors

AKI Acute Kidney Injury

ANA Antinuclear Antibody

ANCA Antineutrophil Cytoplasmic Antibodies

Anti-GBM Ab Anti-glomerular basement membrane antibodies

ARB Angiotensin receptor blockers

AVPU Awake Verbal Pain Unresponsive

BP Blood Pressure

C3 compliment 3

C4 compliment 4

Ca calcium

CBG Capillary blood glucose

CK Creatinine Kinase

CKD Chronic Kidney Disease

CPAP Continuous positive airway pressure

CPR Cardiopulmonary resuscitation

CRP C-reactive protein

C&S Culture and sensitivity

CT Computed tomography

CXR Chest Xray

dsDNA Double stranded Deoxyribonucleic Acid

ECG Electrocardiography

eGFR estimated Glomerular Filtration Rate

FBC Full blood count

FU follow up

GP General practitioner

HIV Human immunodeficiency virus

ICU Intensive Care Unit

IV Intravenous

K+ Potassium

KUB Kidney Ureter Bladder

LDH Lactate dehydrogenase

LFT Liver function test

LMWH Low molecular weight heparin

MAP Mean arterial pressure

MRAs Mineralocorticoid receptor antagonist

NEWS National early warning score

NIV Non invasive ventilation

NSAID Non steroidal anti-inflammatory

NWKN Northwest Kidney Network

PCR Protein creatinine ratio

PH Potential of Hydrogen

RAS Inhibitor Renin Angiotensin system inhibitor

RRT Renal Replacement Therapy

RX Treat

SBP Systolic blood pressure

SDEC Same day emergency care

SGLT2i Sodium-Glucose Transport Protien 2 inhibitors

SLE Systemic Lupus Erythematosus

uACR Urine Albumin Creatinine Ratio

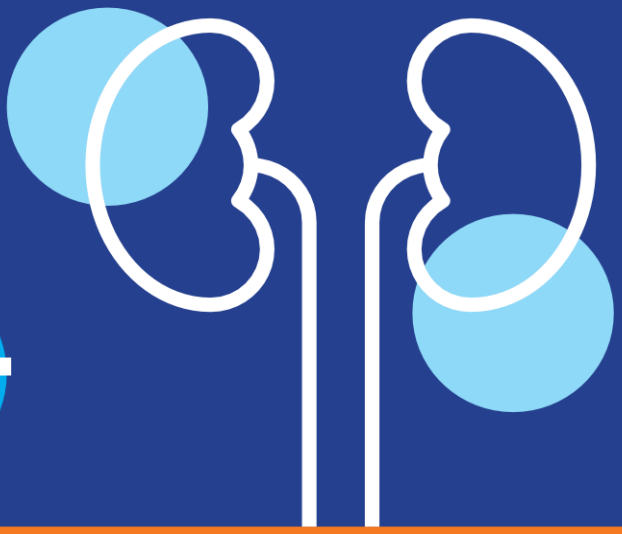
U&E Urea and electrolytes

VBG Venous blood gas

ACUTE KIDNEY INJURY NETWORK

NORTH WEST KIDNEY NETWORK

AKI–Think FLUIDS 24



F **Fluid assessment** Hydrate with IV fluids as necessary within 6hrs.

L **Low BP** Review anti-hypertensive medication – suspend or adjust.

U **Urine output and Urinalysis** – Dip urine and if blood/protein, send renal screen. Intake/ output fluid chart.

I **Imaging,** Kidney scan, if suspected obstruction – urgent.

D **Drugs review,** Nephro-sensitive medications, dose adjust/suspend.

S **If sepsis,** start antibiotics as per sepsis 6 bundle (i.e. treat underlying cause).

Repeat renal function and reassess in **24** hrs

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Appendix one : Document History and Version Control

Version	Date	Comments	Author/ Job Title
1	31st March 2025	Incorporating NICE AKI updated quality dashboard 2023	Dr Shahed Ahmed, Consultant Nephrologist, Shahed.Ahmed@liverpoolft.nhs.uk Other Authors Dr Neil Bailey, Consultant Nephrologist Dr Adam Morris, Consultant Nephrologist Dr Louise Moore, Renal Registrar Amanda-Balshaw Greer, ANP & NWKN QI Manager