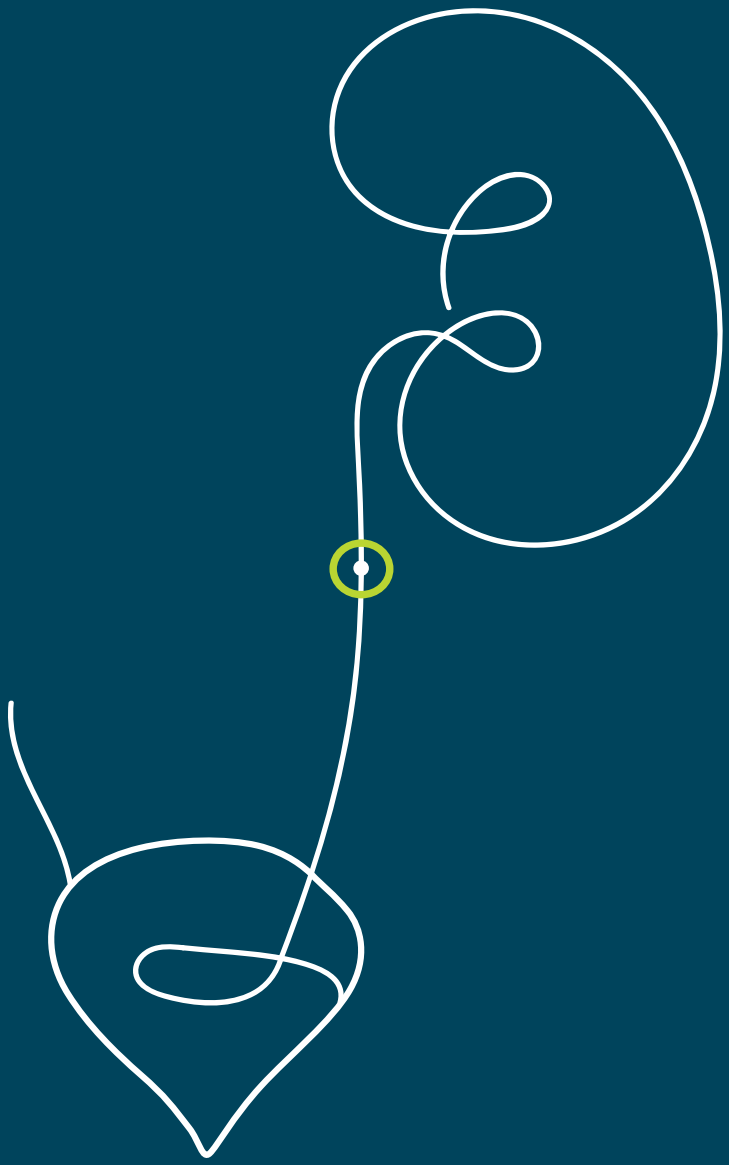
CLINICAL PRACTICE GUIDE

Diagnosis and management of adults with acute ureteric colic

DECEMBER 2023



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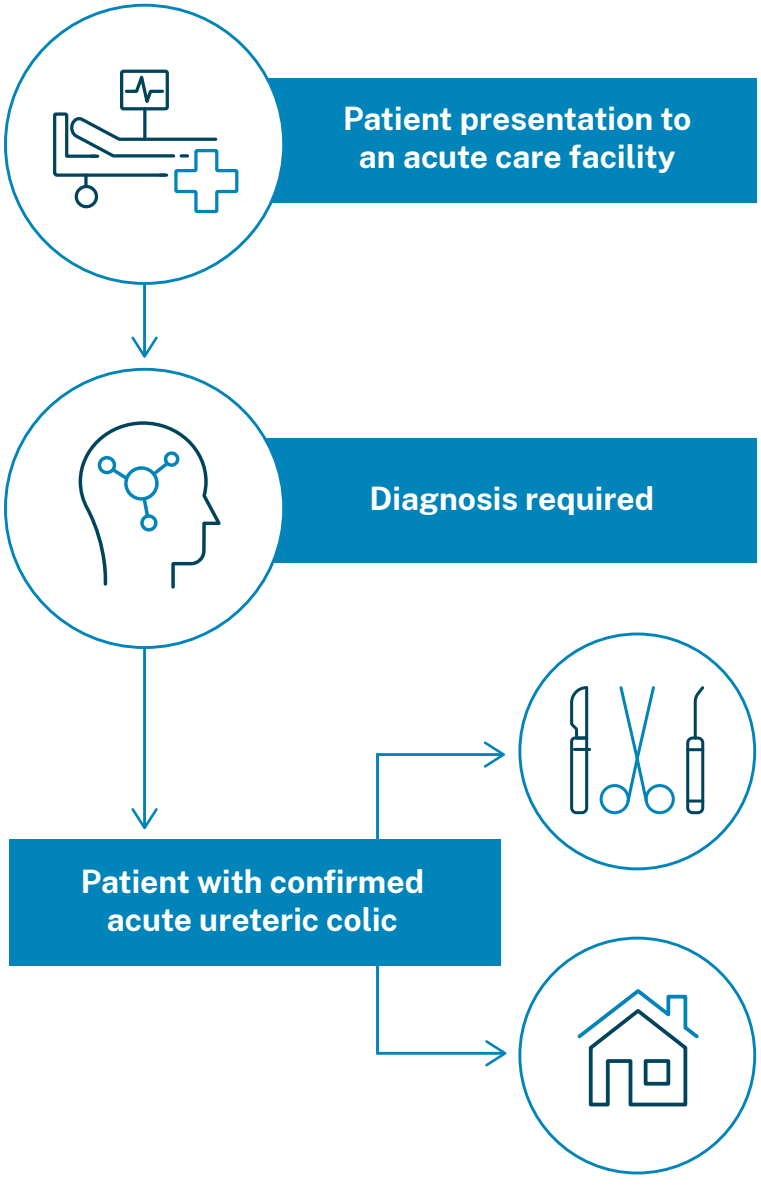
Title	Clinical practice guide: Diagnosis and management of adults with acute ureteric colic		
Published	December 2023		
Next review	2028		
Produced by	Urology Network		
Preferred citation	NSW Agency for Clinical Innovation. Clinical practice guide: Diagnosis and management of adults with acute ureteric colic Sydney: ACI; 2023.		
TRIM ACI/D23/3779	SHPN (ACI) 230796	978-1-76023-637-3	ACI_7791 [12/23]

Diagnosis and management of adults with acute ureteric colic

At a glance

Acute ureteric colic affects a significant proportion of the population. The purpose of this guide is to reduce clinical variation in diagnosis and treatment protocols in NSW hospitals.



Patient presents with signs and symptoms of unconfirmed acute ureteric colic
→ Pages 3, 4

Diagnostic evaluation, diagnostic imaging pathway, laboratory examinations and stone analysis → Pages 7, 8, 17

Surgical treatment recommendations including ureteroscopy, shockwave lithotripsy and ureteric stenting
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Safe provisional discharge recommendations
→ Page 12

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Introduction

Purpose

Acute ureteric colic (AUC) is a condition commonly seen in NSW emergency departments (ED) and affects a significant proportion of the population. There is wide variation in the diagnosis pathway and management of patients presenting with AUC. The purpose of this guide is to reduce clinical variation in diagnosis and treatment protocols in NSW hospitals.

The key audience for this clinical practice guide is physicians and urologists in an acute care setting, who have a patient presenting with signs and symptoms of unconfirmed AUC. Additionally, this guide serves to inform best practice in emergency and planned surgical treatment of AUC.

The Agency for Clinical Innovation (ACI) developed this guide by drawing on the evidence base, having consulted clinical experts and reviewed arrangements in other jurisdictions. This guide was developed between July 2021 and March 2023 by a working group of experienced urologists from a range of local health districts (LHDs) across NSW, and included consultation with a broader group of expert medical representatives. It provides background information and outlines key recommendations for the management of AUC including:

- diagnostic evaluation
- diagnostic imaging pathway
- surgical treatment
- safe provisional discharge.

Background

Ureteric colic is typically caused by the obstruction of the urinary tract by calculi and is associated with severe pain. Patients frequently present with sudden onset of severe and sharp flank pain, often accompanied by nausea, vomiting and/or fever.[1,6] AUC is estimated to affect between 5-15% of the population.[1-4] AUC is a condition frequently seen in NSW EDs and over the last 10 years there has been a 79% increase in patients presenting with stones internal to their urinary system.[5] Urinary stones are treated by combinations of ureteroscopy, shockwave lithotripsy, stenting and/or laser fragmentation. While treatment for AUC also includes percutaneous nephrolithotomy for complex stones or in patients with atypical urological anatomy, this clinical practice guide explores the primary recommendations for common presentations of AUC requiring minimally invasive surgical treatment.[7]

Following emergency presentation with suspected calculi, a diagnostic and treatment pathway for AUC is commenced. Some presentations are self-resolving, requiring non-surgical treatment including analgesia and discharge with appropriate education. In other patients, the acute pain resolves and they are discharged with pain management along with a plan for monitoring and surgical treatment. A third and more complex group have persisting pain, ureteric obstruction or infection with obstruction and require immediate induction to a surgical treatment pathway.

Indications and decision-making processes for surgical treatment and choice of procedure vary between surgeons. Capacity and resource constraints including access to equipment, instrumentation and theatres also play a role.[5] The model of care that is frequently used for complex presentations requiring surgical intervention involves placing a stent past the stone. The patient is then discharged and re-admitted later for definitive management. Primary stent insertion can be associated with poorer outcomes and higher readmission rates, and prolonged dwell times can be associated with complications.[5-9]

While primary stenting can be appropriate in certain cases, the evidence does not support routine stenting in accompaniment to shockwave lithotripsy or primary uncomplicated ureteroscopy.[6-9,11,12,14]

Definitive management supported by the evidence includes shockwave lithotripsy or ureteroscopy on presentation, or an arrangement for early definitive treatment within two to seven days.[7,11,12,15] If patients are pre-stented, to reduce complications the stent dwell time should be limited to less than one month and ideally less than seven days.[5,16-26]

Terminology

Urinary stone disease (USD) and AUC are terms commonly used in research for stones in the ureters. USD is a generic term that reflects the presence of stones and calcification in the urinary tract.[27] In contrast, AUC refers specifically to acute presentations that are primarily associated with severe pain. While urinary stones are the most prevalent cause of AUC, there are other less frequent causes. These include injury, surgery and other conditions such as lymphadenopathy, blood clots (due to upper tract bleeding) or sloughed renal papilla (due to sickle cell disease, diabetes and long-term use of analgesics).[28] To holistically capture evidence on management pathways for acute presentations of ureteric colic, evidence reports for both USD and AUC have been used to inform this clinical practice guide.

Methodology

The ACI evidence report titled, Urinary stone disease: Incidence, treatment and outcomes in NSW and the ACI evidence check titled Acute ureteric colic are published alongside this clinical practice guide. They summarise the evidence available on management of acute presentations in NSW and internationally.[5,29]

ACI evidence report: Urinary stone disease

The ACI evidence report on urinary stone disease drew on three main types of evidence:[5]

1. Quantitative data from NSW Admitted Patient Data Collection (APDC), NSW Emergency Department Data Collection (EDDC) and NSW Waiting List Collection Online System (WLCOS).
2. Research literature:
    - 31 studies were included from peer reviewed literature and five publications from grey literature
    - studies were identified through PubMed and Google searches in June 2021
    - searches were conducted using key terms related to: 'urinary calculi OR kidney stones OR renal stones AND stents'
    - studies were included if they were systematic reviews published in English language between 2011 and 2021 such as meta-analyses, randomised controlled trials, clinical trials or observational studies. Population was people with USD and intervention was 'stenting compared to other treatment'. Surgical management guidelines were identified in grey literature
    - studies were independently screened by two people, first by title and abstract and subsequently by full text. Conflicts were discussed in virtual meetings and resolved by a third screener.
3. Experiential evidence was collected from 25 responses to a self-reported brief questionnaire from 1 December 2021 to 31 March 2022. Respondents included seven urologists and 18 nurses, including two nurse practitioners and one clinical nurse consultant in NSW.

ACI evidence check: Acute ureteric colic

Evidence checks are based on a simplified review method and may not be entirely exhaustive but aim to provide a balanced assessment of what is already known about a specific problem or issue.

Research literature:

- the ACI evidence check on AUC elicited 45 results and drew on research literature including peer reviewed and grey literature[29]
- the evidence check question was, 'what is the evidence for emergency treatment of acute ureteric colic?'
- PubMed and Google were searched on 16 November 2022 and 6 December 2022
- PubMed search terms include 'renal colic OR acute ureteric colic OR acute ureteral colic OR acute renal colic OR ureteric colic OR ureteral colic AND treat* OR guideline* OR manage* AND emergency* OR hospital* OR emergency medical services OR emergency service, hospital'
- the grey literature search was conducted using Google and search terms were 'acute ureteric colic AND guidelines'.
- Inclusion criteria:
  - published in English
  - between 2012 and present
  - studies reporting empirical data including modelling studies, and systematic review articles.
- Exclusion criteria:
  - letters, comments, editorials, study protocols, case reports or conference abstracts
  - abstract only
  - studies from non-OECD countries
  - studies or results related to: pain management for AUC, medical expulsive therapy, COVID-19, non-emergency intervention, paediatric patients.

Hospitalisations and surgical procedures in NSW Hospitals

Key findings in the ACI evidence report on urinary stone disease from the analysis of health and healthcare databases were as follows:[5]

- In 2018-19, 11,307 people were admitted to NSW public and private hospitals with USD as the principal diagnosis. Among these, 7,988 were male (71%) and 3,319 were female (29%). Those admitted were aged between 3-99 years, with a median age of 53 and an interquartile range of 24 (41 to 65). In that year, there were 15,736 admitted patient episodes, revealing a significant number of readmissions with USD as the principal diagnosis.
- Among patients who had a procedure for USD in 2018-19, the most common initial procedure was ureteric stent insertion (65%), followed by ureteric stent insertion and stone removal during the same hospital admission (30%). Among the 2,901 people who had initial ureteric stent insertion, 42% had a subsequent procedure (stone removal or extracorporeal shockwave lithotripsy) within one year.
- In 2018-19, among the 2,901 people with USD as principal diagnosis who underwent ureteric stent insertion first, 1,226 (42%) had a subsequent procedure (stone removal or ESWL) within one year.
- In 2018-19, there were 696 'insertion of ureteric stent' procedures and 749 'removal of stone from urinary tract' procedures performed from the NSW public hospital elective surgery waitlist. They were mostly classified as semi-urgent (42% for stent insertion and 72% for stone removal).
- Over a three-year period (2016-19), all-cause unplanned ED presentations following initial USD procedures were more common in patients whose procedure involved stenting, compared with patients whose first procedure was stone removal. For example, 21% of patients who underwent an emergency stent insertion had an unplanned ED presentation within 30 days compared with 14% of patients who had an emergency stone removal. Similarly, 15% of patients who underwent a planned stent insertion had an unplanned ED presentation within 30 days compared with 8% of patients who had a planned stone removal. In summary, the odds of an unplanned ED presentation at 30, 60, and 90 days following stone removal were lower when compared with stent insertion. In addition, it was statistically significant for patients who underwent planned stent insertion.

Local guidelines and resource availability

This evidence-based clinical practice guide reflects best practice in the diagnosis, treatment and discharge of patients experiencing AUC. The working group acknowledge that the guidelines may need to be modified depending on local availability of resources. In areas without 24/7 urology cover and in rural and remote locations, safety considerations may influence pathways.

Clinical criteria

Diagnostic evaluation

A diagnosis should be made for every patient presenting to an ED with AUC via diagnostic imaging and laboratory examination. Holistic diagnostic evaluation facilitates accurate diagnosis and will determine the necessity, urgency and form of treatment including surgical intervention. The diagnostic imaging pathway shown in Appendix 1, provides guidance on imaging considering the patient's clinical presentation including age, recurrence, symptoms, anatomy, deterioration and pregnancy.

Diagnostic imaging

Diagnostic imaging is frequently used for the diagnosis and management of ureteric colic. Imaging options include computed tomography (CT), ultrasound (US) and kidney-ureter-bladder (KUB) X-ray. The most appropriate imaging modality will be determined by the clinical situation.[30] The diagnostic imaging pathway in Appendix 1 provides guidance on the appropriate imaging for the clinical presentation. Ultrasound is advisable as first-line imaging in uncomplicated presentations and also assists in ruling out other causes. Radiation in younger patients should be avoided where possible.

Non-contrast-enhanced CT:

- best practice imaging modality for the diagnosis of AUC, with high sensitivity (95-100%) and specificity (94-96%)[1,6,32-39]
- replaces intravenous urography (IVU)
- determines stone diameter and density
- is significantly more accurate than non-CT IVU or US[40]
- carries a higher radiation risk than US or plain X-ray[32,41]
- the use of low-dose CT is recommended to reduce radiation risk[6,30,42]
- low-dose unenhanced CT has a similar diagnostic performance to regular unenhanced CT.[43]

Indications for CT-KUB during ED presentation:[32]

- clinical evidence of associated UTI
- age > 50 years with atypical signs and symptoms
- recurrent or unremitting pain (depending on clinical judgement and patient presentation, an ultrasound is recommended initially for patients with typical signs and symptoms)
- presentation not definitively clinically typical for ureteric colic
- single kidney
- renal impairment
- renal transplant.

Contraindications**:**

- pregnancy.

Ultrasound KUB:

- viable alternative to CT, with the advantages of availability, lower cost and absence of radiation[1, 33]
- demonstrates hydronephrosis and can show intra-renal or very proximal ureteric calculi
- sensitivity is lower than computed tomography; poor at imaging ureter and ureteric calculi[15,32,34]
- useful in eliminating other causes such as an aneurysm.[32]

Indications for ultrasound-KUB

- follow-up imaging
- pregnancy.[32]

Plain KUB:

KUB X-ray is of minimal benefit in confirming or excluding the diagnosis and should not be ordered routinely. Exceptions may be in a patient with a known radio-opaque stone where X-ray may show stone progression.[32]

Table 1. Diagnostic imaging recommendations from the evidence

Recommendations - Diagnostic imaging	Evidence strength rating
Immediate imaging is indicated with fever or solitary kidney and when diagnosis is doubtful.	Strong
Where indicated, following initial ultrasound assessment, use non-contrast-enhanced CT to confirm stone diagnosis in patients with acute flank pain.	Strong
Perform a contrast study if stone removal is planned and the anatomy of the renal collecting system needs to be assessed.	Strong

Adapted from European Association of Urology.[31]

Laboratory examinations and stone analysis

Beyond imaging, each patient with suspected urolithiasis requires an initial biochemical work-up which may include urinary dipstick testing, urine culture and sensitivity, and haematological work-up including full blood count, renal profile, uric acid, calcium level and C-reactive protein.[1,33-35]

In emergency settings, a C-reactive protein test is recommended. While uric acid and calcium tests may not be achievable, these can be done as an outpatient. Patients should receive instructions to examine all urine to catch the stone for retrieval and analysis.

Table 2. Laboratory examinations and stone analysis recommendations from the evidence

Recommendations - Laboratory examinations and stone analysis	Evidence strength rating
Urine	
Dipstick test of spot urine sample: • red cells • white cells • nitrites • approximate urine pH • urine microscopy and/or culture	Weak
Blood	
Serum blood sample: • creatinine • uric acid • (ionised) calcium • sodium • potassium • blood cell count • C-reactive protein	Strong
Perform stone analysis in first-time formers using a valid procedure (X-ray diffraction or infrared spectroscopy).	Strong

Adapted from European Association of Urology.[31]

Surgical treatment

Surgical treatments recommended in this clinical practice guide include ureteroscopy and shockwave lithotripsy. Ureteric stenting is advisable in certain clinical presentations and a timeline for stent retrieval is outlined. Generally, the main indications for operative intervention of stones include fever, infection, urinary tract obstruction and unremitting pain.[18,44] The recommendations for each procedure including indications and contraindications can be found on pages 10, 11.

Goals of surgical intervention are to:

- relieve patient discomfort[44]
- clear infection[44]
- manage / prevent sepsis
- render patients stone-free
- minimise stent dwell time
- minimise risk of complication.

Indications for emergency surgery:

- fever[13,22]
- progressive acute kidney injury[13]
- obstructed infected kidney[33,45]
- obstructed solitary kidney[33,44,45]
- bilateral obstruction[33,44,45]
- resistance to standard analgesics[13]
- uncontrolled pain[22,33,45]
- nausea and vomiting not relieved by medication[22]
- recurrent visits to ED.[13]

Contraindications for emergency surgery

There are no absolute contraindications to stone removal surgery. The following should be considered:

- fitness for general anaesthesia
- risk of complication
- pregnancy and comorbidities.[44]

Recommendations for surgical procedures

All surgical procedures listed on pages 10, 11 can be performed in emergency and elective situations depending on the patient's clinical presentation. The National Institute for Health and Care Excellence, UpToDate and The British Association of Urological Surgeons recommend ureteroscopy or shockwave lithotripsy as initial treatment for removing ureteral stones.[7,11,12,15] Treatment is advised within 48 hours of diagnosis if pain is ongoing or the stone is unlikely to pass.[7,11,12] Generally, the probability of spontaneous stone passage decreases as stone size increases.[46] Stones 5mm or less are more likely to pass spontaneously.[6,13,34,47] Stones 9mm or larger are more likely to require emergency intervention, and early intervention is shown to provide better patient outcomes.[29] Patient factors that guide the choice of the surgical procedure include previous patient experiences, occupation, perceptions about treatment and comorbidities.[5]

If patients are stented, it is recommended to limit stent dwell time to less than one month and ideally less than seven days. This is to avoid complications associated with prolonged dwell times.[5,16-26] Research from the USD evidence report found mixed outcomes for stenting versus no stenting in patients with urinary stone disease, and the association between exact stent dwell times and complications.[5] Notably, however, much of the available research that reported on outcomes of stenting was derived predominantly from evidence that did not focus primarily on outcomes of stenting. The evidence was also significantly heterogeneous in terms of type of stent, outcomes reported and patient cohort.[5] Recommendations regarding stenting provided in this clinical practice guide are derived from a combination of evidence focussed on stenting, advice from clinical experts and best practice guidelines from peak professional bodies.

Ureteroscopy

Primary ureteroscopy can always be considered, except in the following situations:

- sepsis
- large proximal stones
- no laser available
- inadequate supervision.

Ureteroscopy may not be possible or contraindicated in the presence of infection.

Primary ureteroscopy by a registrar is recommended to be undertaken with adequate supervision onsite for select cases, e.g. smaller, more distal stones. In these presentations, if adequate supervision is not available, primary stenting is indicated with a rapid pathway to subsequent ureteroscopy.

Primary ureteroscopy could be facilitated by establishing models of care where patients are treated with minimum delay, such as reserved theatre time on a regular (at least weekly) basis.

The American Urological Association, Canadian Urological Association, European Association of Urology and The British Association of Urological Surgeons guidelines do not recommend routine ureteric stenting for primary uncomplicated ureteroscopy.[6-9,14]

On grounds of safety, particularly in rural and remote locations where resources and after-hours access is limited, ureteric stenting for primary uncomplicated ureteroscopy may be considered to ensure drainage.

Shockwave lithotripsy (SWL)

The American Urological Association recommends that patients are informed SWL has lower morbidity than ureteroscopy.[8]

The rationale for use of immediate SWL is to attain maximum stone clearance rate in the shortest possible time, using the least invasive therapy.[45]

Shockwave lithotripsy should not be performed in patients who are pregnant, have abdominal aortic aneurysm or have an uncontrolled bleeding diathesis.[44]

SWL treatment is dependent on the availability of equipment and staff with the required expertise.

According to the National Institute for Health and Care Excellence and the American Urological Association, routine stenting is not recommended for adults undergoing shockwave lithotripsy.[8,11]

Ureteric stenting

Routine stenting is not recommended for primary uncomplicated ureteroscopy and adults undergoing shockwave lithotripsy, and stents may impede beneficial outcomes for stones 10-20mm.[5-9,11,14]

Complications associated with stenting include higher rates of haematuria, urinary symptoms, urinary infection, dysuria, postoperative urosepsis, stent encrustation, stent migration, stent fragmentation, stent irritation and stent discomfort.[5,16,17-20]

If stenting is performed, then the definitive procedure should be performed as soon as practicable and within 72 hours or ideally within seven days after the primary stenting. This can be managed by establishing a system of reserved theatre time for stented patients. If such a system is not established, then:

- definitive treatment is recommended to be undertaken within one week, with a maximum of one month[5,21]
- no stented patient should remain over a month with a stent. The procedure should be considered Category 1 if listed for elective surgery.

Note: a mandatory MSU should be completed before the procedure.

These recommendations should reduce the time that stents are used to temporise before definitive treatment of ureteric stones. Serious infectious and encrustation related complications can be reduced by decreasing stent dwell time.[18,21,22]

Extended dwell time considerations:

- In complex patients, stents should not exceed one year in situ. Importantly noting that in known stone formers, complication risk increases after one month.
- Prolonged duration of indwelling stent time is associated with urinary tract infections, stent migration, stent fragmentation, storage lower urinary tract symptoms, stent encrustation, higher risk of operative sepsis, and perception of pain related to the stent or stent removal.[16-18,20-26]
- Forgotten or encrusted stents may lead to a range of significant complications including infection and loss of renal function.[16,18,20,24,25] A multimodal approach and more complex operations may be required for the management and removal of forgotten stents.[16-20,22]

Thorough patient education is recommended to reduce complications associated with stenting. Poor patient compliance and low health literacy levels increase the risk of chronically retained stents.[18-20]

Pregnancy and ureteric colic

Pregnant patients must be treated clinically with input from an obstetrician. The first diagnostic step is an ultrasonographic examination: real-time ultrasound demonstrates the renal parenchyma, calyceal system, dilated ureter and occasionally the offending calculus, without radiation exposure.[43] However, ultrasound is potentially confusing as many pregnant women have dilated ureters and renal collecting systems. Looking for ureteric jets may be helpful but does not exclude a stone in the ureter.

While ultrasound is first-line diagnostic imaging in pregnancy, a plain X-ray after the first trimester can be useful, especially if there is an opacity in the line of the ureter. If there are diagnostic difficulties, an obstetrician consultation and potentially magnetic resonance imaging (MRI) could provide conclusive evidence.

Obstructing ureteral stones in pregnancy can be managed conservatively in the absence of suspected or confirmed urinary infection.[9] Ureteroscopy is a safe option for evaluation of pregnant patients with unresolved ureteric colic.[48] Ureteroscopy with laser lithotripsy is shown to be safe in pregnancy; however, SWL is contraindicated in pregnancy.[9,44]

Safe provisional discharge

The following recommendations are for safe provisional discharge of both post-surgical patients and of patients not requiring surgery at the time of acute presentation. These recommendations must be considered along with any other clinical or social risk factors that may impact safe discharge:

- Mobility - steady gait, no dizziness, can mobilise independently or achieves preadmission level.
- Adequate pain relief.
- Minimal haematuria (light pink coloured urine).
- Physiological observations are within normal parameters for patient.
- Negative urinalysis and history of infection.

If the stone has not passed, patients should receive instructions to examine all urine to catch the stone for retrieval and analysis once discharged. Furthermore, if a stent has been inserted, patients require education regarding an appropriate dwell time and follow-up.

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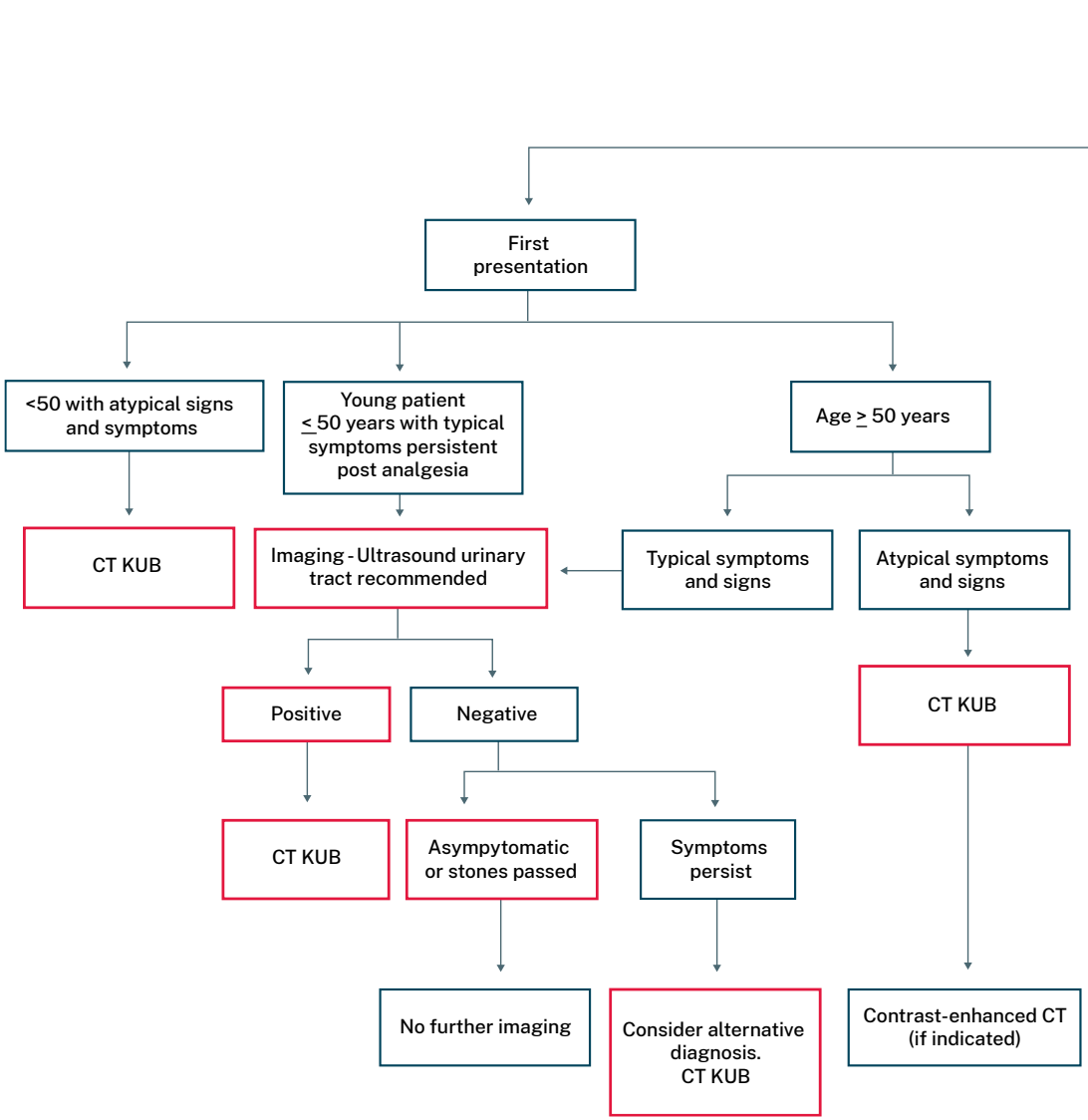
Appendix 1. Diagnostic imaging pathway – presentations of loin pain



What do I need to know?

Is this the first presentation?

Is the patient <50 years old?

Is the patient pregnant?

Is the patient clinically unwell?

Does the patient have renal failure or a single kidney?

Are there typical symptoms and signs suggestive of acute ureteric colic?

Is intervention contemplated?

Adapted from Diagnostic Imaging Pathways and Radiology Across Borders[49]

Acknowledgements

The ACI Urology Network led the development of this clinical practice guide. It was developed in consultation with the Acute Ureteric Colic Working Group. The ACI would like to acknowledge and recognise the contribution and expertise of the members of the working group including:

Andrew Brooks AM, Urologist, Associate Professor, Clinical Director of Surgery Westmead Private Hospital, Head of Sydney West Area Health Service Department of Urology, Co-Chair ACI Urology Network

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David Habashy, Urologist

Kayvan Haghighi, Urologist, Head of Department, Campbelltown Hospital

Bala Indrajit, Urologist

Finlay Macneil, Urologist

James Macneil, Urology Registrar

Robert Thomas, Urologist

Clair Whelan, Urologist, Director of Surgery, Orange Health Service.

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