

Renal colic - acute - Management

Scenario: Diagnosis of acute renal colic

How should I diagnose acute renal colic?

- **Suspect acute renal colic in people presenting with an abrupt onset of severe unilateral abdominal pain originating in the loin or flank, radiating to the labia in women or to the groin or testicles in men.**
 - The pain lasts minutes to hours and occurs in spasms, with intervals of no pain or dull ache.
 - The site of the pain is not a very reliable indicator of the site of the stone, and flank pain alone is not a specific symptom of ureteric calculi.
 - The person is restless and cannot lie still (which helps to differentiate renal colic from peritonitis).
 - The pain is often accompanied by nausea, vomiting, frequent urination, dysuria, oliguria, and microscopic haematuria (although gross haematuria is also possible).
 - Peritoneal signs are absent.
 - There may be a history of previous episodes.
- **Where possible, perform urine dipstick testing to support the diagnosis (check for erythrocytes) and to exclude infection (check for nitrite and leukocyte esterase).**
 - The presence of erythrocytes (haematuria) can be helpful to support the diagnosis of acute renal colic. However, specificity and positive predictive values are poor. A negative result does not exclude a diagnosis of acute renal colic.
 - Urine testing might not always be appropriate (for example in people who might not be able to void on demand, or in menstruating women).
- **[Exclude other diagnosis](#), such as appendicitis (if the pain is right-sided), diverticulitis (if the pain is left-sided), pyelonephritis, salpingitis in women, or ruptured aortic aneurysm (particularly in men older than 50 years of age with a first presentation of suspected renal colic) which can mimic left-sided ureteric colic.**
- **Look for signs which may indicate a complication.**
 - Fever — suggests coexisting urinary tract infection or pyonephrosis (requiring immediate admission).

- Hesitancy of micturition or an intermittent urinary stream — suggests obstruction.

Basis for recommendation

This list of differential diagnoses is mainly derived from expert opinion in narrative reviews [[Dawson and Whitfield, 1996](#); [Leslie, 2007](#)].

- The inclusion of factitious renal colic, including Munchausen's syndrome and drug dependence, is based on several case reports and case series [[Gluckman and Stoller, 1993](#); [Reich and Hanno, 1997](#); [Attar et al, 2004](#); [Ting, 2008](#)].

What else might it be?

Other cause of acute abdominal pain include:

- **Renal**

- Pyelonephritis.
- Obstruction of the ureter due to other causes (such as a blood clot, stricture, papillary necrosis, or urothelial tumour).
- Acute renal infarction.
- Renal rupture.
- Renal abscess (very rare, and in the UK usually secondary to stones).

- **Gynaecological**

- Ectopic pregnancy.
- Endometriosis.
- Ovarian cyst: rupture or torsion.
- Pelvic inflammatory disease.
- Salpingitis.

- **Gastrointestinal**

- Appendicitis.
- Diverticulitis.

- Biliary colic.
- Bowel obstruction.
- Bowel ischaemia.
- Crohn's disease.
- **Cardiovascular**
- Leaking aortic aneurysm.
- Cardiac ischaemia.
- **Other**
- Musculoskeletal pain.
- Herpes zoster.
- Pneumonia or pleurisy.
- Radiculitis.
- Rib pain, such as fracture.
- Factitious renal colic: Munchausen's syndrome, people with drug dependence.

Basis for recommendation

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Scenario: Renal colic - acute

How should I manage an acute episode of renal colic?

- **Relieve pain, nausea, and vomiting** (see [Management of pain and vomiting](#)).

- **Decide whether to admit the person or manage them at home** (see [Admission or home management](#)).
- **If managing the person at home:**
 - Assess the response to initial analgesic and anti-emetic treatment, and admit them if there is no response within 1 hour of drug administration (or sooner depending on clinical judgement).
 - Prescribe a supply of oral or rectal analgesia and/or anti-emetic for ongoing relief.
 - For drug choice, see [Management of pain and vomiting](#).
 - Advise a normal fluid intake to maintain colourless urine. Yellow or brown urine is too concentrated.
 - Explain that the stone may pass spontaneously (see [Prognosis](#)) and advise, if possible, to sieve the urine through a tea strainer, a nylon stocking or filter paper (such as a coffee filter) to capture the stone. This can be done directly as the urine is passed. Alternatively, the urine can be collected into a container before sieving.
 - If a stone is captured, send it to the laboratory for analysis.
 - Advise the person to seek urgent medical assistance:
 - If they develop a fever or rigors, *or*
 - If the pain worsens, *or*
 - If they have abrupt recurrence of severe pain.
 - Refer the person urgently for secondary care investigations (see [Follow up and referral](#)).

Basis for recommendation

These recommendations are based on expert opinion [[Dawson and Whitfield, 1996](#); [Wright et al, 2002](#); [Parmar, 2004](#); [Teichman, 2004](#); [Davenport et al, 2005](#); [Reynolds, 2005](#); [Pietrow and Karellas, 2006](#); [Masarani and Dinneen, 2007](#); [Miller and Lingeman, 2007](#); [Thomas, 2007](#); [Welk and Teichman, 2007](#); [European Association of Urology, 2008](#); [Rees, 2008](#)].

Conservative management with appropriate analgesia and hydration

- This is preferred if urgent intervention is not necessary and there is a low risk of renal damage, no clinical evidence of sepsis and the pain is well controlled [[Parmar, 2004](#); [Teichman, 2004](#); [European Association of Urology, 2008](#)].

- About 10–20% of kidney stones need radiological or surgical intervention to remove them [[Parmar, 2004](#)].
- For further information regarding the likelihood of spontaneous stone passage, see [Prognosis](#).

Fluid intake

- Although maintaining a high fluid intake has been recommended [[Wright et al, 2002](#)], some experts warn that forced diuresis with high fluid intake can increase the degree of hydronephrosis, leading to decreased ureteric peristalsis and reducing the chance of spontaneous stone passage [[Dawson and Whitfield, 1996](#); [Rees, 2008](#)].
- Although treatments that increase renal fluid output, such as diuretics or high-volume fluid therapy, might in theory facilitate stone passage because of the associated increased hydrostatic pressure in the ureter, a Cochrane systematic review found no credible [evidence](#) to support the use of either treatment [[Worster and Richards, 2005](#)].
- Given the lack of evidence, CKS recommends a normal fluid intake that avoids the urine being concentrated.

Sieving the urine to capture the stone

- This is recommended by experts [[ICES, 1998](#); [Wright et al, 2002](#); [Teichman, 2004](#); [Miller and Lingeman, 2007](#); [Thomas, 2007](#); [European Association of Urology, 2008](#); [Rees, 2008](#)].
- Stone analysis can aid decisions regarding the need for metabolic evaluation and medical treatment (especially if non-calcium stones, such as cystine or urate stones, are found) [[Reynolds, 2005](#); [European Association of Urology, 2008](#)].
- For people with recurrent stones, the European Association of Urology recommends that repeated analysis is indicated if there are changes to medical treatment, dietary habits, disease state or environmental factors which could lead to changes in urine composition and influence stone composition [[European Association of Urology, 2008](#)].

How should I manage pain and vomiting?

- **Administer a parenteral analgesic for rapid relief of severe pain.**
- Give diclofenac 75 mg intramuscularly unless contraindicated (see Prescribing information on [diclofenac](#)). A second 75 mg dose may be given after 30 minutes if necessary.

- Consider an opioid (for example diamorphine) if diclofenac is not suitable or is insufficient to control the pain:
- Diamorphine: 5 mg (up to 10 mg for heavier, well muscled people or 2.5 mg for people who are frail or elderly) intramuscularly or subcutaneously (the latter is generally less painful) or 1.25–2.5 mg by slow intravenous injection.
- Use the intramuscular route if metoclopramide (10 mg) is mixed with diamorphine (10 mg or less) in the same syringe.
- **Administer an anti-emetic for nausea and vomiting** (particularly if an injectable opioid is given):
 - Metoclopramide (but avoid in people younger than 20 years of age): 10 mg intramuscularly. Reduce the dose by 25–50% in people with moderate or severe renal impairment.
 - Cyclizine: 50 mg intramuscularly.
 - Prochlorperazine: 12.5 mg by deep intramuscular injection. Reduce the dose by 50% in people with severe renal impairment.
- **Consider an oral or rectal analgesic and anti-emetic if symptoms are less severe, or for ongoing relief.**
 - For pain:
 - Offer a nonsteroidal anti-inflammatory drug (NSAID), such as diclofenac, which can be given orally or rectally (see Prescribing information on [diclofenac](#)).
 - If an NSAID is not suitable, offer paracetamol and a weak opioid (such as codeine or tramadol).
 - For nausea and vomiting:
 - Oral anti-emetic: metoclopramide (10 mg three times daily), domperidone (10–20 mg three or four times daily), prochlorperazine (for acute management: 20 mg initially, then 10 mg after 2 hours; for prevention: 5–10 mg two or three times daily), or cyclizine (50 mg three times daily).
 - Rectal anti-emetic: domperidone (60 mg twice daily).

Basis for recommendation

These recommendations are based on expert opinion and limited evidence [[Bihl and Meyers, 2001](#); [Wright et al, 2002](#); [Holdgate and Pollock, 2004](#); [Davenport et al, 2005](#); [Miller and Lingeman, 2007](#); [Thomas, 2007](#); [Welk and Teichman, 2007](#); [European Association of Urology, 2008](#); [Rees, 2008](#)].

Parenteral route

- For managing severe acute renal colic pain, the parenteral route is preferred because it has the most rapid onset of action [[Teichman, 2004](#); [Davenport et al, 2005](#)].

Nonsteroidal anti-inflammatory drugs (NSAIDs)

- NSAIDs are thought to provide effective analgesia by blocking afferent arteriolar vasodilatation (by inhibiting prostaglandin synthesis), thus reducing diuresis, oedema, and ureteric smooth muscle stimulation [[Teichman, 2004](#); [Welk and Teichman, 2007](#); [Stewart and Joyce, 2008](#)].
- For parenteral administration, although both NSAIDs and opioids provide effective analgesia in acute renal colic, limited [evidence](#) from a Cochrane review found that [[Holdgate and Pollock, 2004](#)]:
 - People treated with NSAIDs generally reported greater relief with an NSAID and were less likely to require rescue medication.
 - NSAIDs were associated with a lower incidence of adverse effects (particularly vomiting) compared with opioids when given parenterally.
- Choice of injectable NSAIDs:
 - Intramuscular diclofenac is licensed for the relief of pain from acute renal colic and is recommended as a first-line treatment by most experts [[Wright et al, 2002](#); [ABPI Medicines Compendium, 2007](#); [Welk and Teichman, 2007](#); [European Association of Urology, 2008](#); [Rees, 2008](#)].
 - Although the Cochrane review found evidence supporting the use of ketorolac as well as diclofenac [[Holdgate and Pollock, 2004](#)], ketorolac is not routinely carried by GPs in their emergency bags and is thus not usually a practical option for the management of renal colic in primary care.
- Regular oral or rectal NSAIDs for prevention of recurrent pain episodes are not recommended for people who have become asymptomatic, particularly if the stone has passed spontaneously.
 - For people with ureteric stones that are expected to pass spontaneously, the European Association of Urology recommends the use of rectal or oral diclofenac to reduce the inflammatory process and the risk of recurrent pain [[European Association of Urology, 2008](#)]. This recommendation is extrapolated from weak [evidence](#) from a small double-blind placebo-controlled trial (n = 44) which found oral diclofenac was effective as short-term prophylaxis of new colic episodes, especially during the first 4 days, and reduces the number of hospital re-admissions [[Laerum et al, 1995](#)].
 - However, given the weak [evidence](#), CKS expert reviewers did not support the continued use of regular NSAIDs if the person becomes asymptomatic, particularly if the stone has passed spontaneously.

Choice of injectable opioid

- Diamorphine can be considered and is commonly carried by GPs in their emergency bag [[DTB, 2005](#)].
- Although pethidine is recommended by the British National Formulary (BNF) for relieving ureteric colic pain [[BNF 56, 2008](#)], it is less preferred because a [subgroup analysis](#) from a Cochrane review found the risk of vomiting to be higher with pethidine than with other opioids [[Holdgate and Pollock, 2004](#)].

Use of anti-emetics

- CKS found no trials investigating the use of anti-emetics in people with acute renal colic.
- However, anti-emetics are routinely used for managing nausea and vomiting, particularly when an injectable opioid is given [[BNF 56, 2008](#); [Stewart and Joyce, 2008](#)].

Who should I admit and who should I manage at home?

- **Admit immediately anyone with suspected acute renal colic if:**
 - They are in shock or have fever or signs of systemic infection (which can lead to life-threatening sepsis).
 - They are at increased risk from loss of renal function (and require emergency imaging and drainage to prevent irreversible loss of renal function):
 - Solitary or transplanted kidney.
 - Pre-existing renal impairment.
 - Bilateral obstructing stones are suspected.
 - They do not respond to appropriate analgesic and anti-emetic treatment within 1 hour (or sooner, depending on clinical judgement).
 - They have abrupt recurrence of severe pain despite initial analgesia.
 - They are dehydrated and cannot take oral fluids due to vomiting — they require intravenous fluids.
 - There is uncertainty regarding the diagnosis (for example if a leaking abdominal aortic aneurysm cannot be excluded).
- **Other criteria for hospital admission are:**
 - Woman of reproductive age and recent delayed menstrual period, as there is a risk of ectopic pregnancy.

- People older than 60 years of age, especially men with left-sided pain, because of the risk of misdiagnosing a leaking abdominal aortic aneurysm (symptoms are similar).
- Pregnant women.
- Patient preference for admission.
- Contact by telephone is not possible.
- The person has no reliable social support.
- **Home treatment may be appropriate provided there are no indications for urgent admission and all of the following apply:**
 - The initial pain has subsided, either spontaneously or within 1 hour of administration of analgesia.
 - There is adequate social support.
 - Contact by telephone is possible.
 - The person is willing to stay at home.
 - Ideally, the person should be younger than 60 years of age.

Basis for recommendation

The recommendations for immediate hospital admission are based on expert opinion [[ICES, 1998](#); [Wright et al, 2002](#); [Sandhu et al, 2003b](#); [Miller and Lingeman, 2007](#); [Welk and Teichman, 2007](#); [European Association of Urology, 2008](#); [Rees, 2008](#)].

- The criteria for home management are taken from an English guideline developed by a multi-disciplinary consensus group and are based on expert opinion [[Wright et al, 2002](#)].
- For pregnant women, the European Association of Urology recommends hospital admission because of the possible obstetric complications associated with urolithiasis, including pre-term labour and pre-term premature rupture of membranes [[European Association of Urology, 2008](#)]. Failure to promptly diagnose and manage urinary stones during pregnancy may have adverse consequences for mother and fetus.

What follow up and referral are recommended?

- **For people managed at home who have become asymptomatic or are controlled with simple analgesics:**

- Arrange fast-track hospital referral so that [diagnostic investigations](#) (such as non-contrast helical computed tomography and intravenous urography) can be done.
- This should usually be done within 7 days of the onset of symptoms, or depending on local policy.
- If this is not available, consider an urgent referral to urology or seek advice from a urologist.
- While awaiting referral:
 - Check for urinary tract infection (if this has not already been done) by:
 - Sending a urine sample for culture, *or*
 - Testing the urine with a dipstick and sending a urine sample for culture if the result is positive.
 - Assess renal function:
 - Check serum creatinine, urea, and electrolytes (see [Additional information](#)).
 - Check blood biochemistry for common causes of renal stones:
 - Calcium, phosphate, and urate (see [Additional information](#)).
 - Analyse the stone (if possible).
- For information on secondary care investigations and treatments, see [Secondary care investigations and treatments](#).

Additional information

- Urinary tract infection:
 - A test for bacteriuria is recommended for all people with a suspected acute stone episode. Dipsticks might be sufficient in uncomplicated cases (but culture the urine if the dipstick is positive) [[European Association of Urology, 2008](#)]. In others, urine culture is necessary.
- Serum creatinine and blood urea:
 - Although serum creatinine and urea can be helpful in determining the presence of obstruction, normal levels do not rule out an obstruction [[ICES, 1998](#)].
 - Of the two, serum creatinine is preferred, as blood urea can be influenced by the degree of hydration and rate of metabolism [[Whitfield, 2006](#)].

- The extent of reserve renal function means there must be a loss of two-thirds of overall renal function before the serum creatinine level increases [[Whitfield, 2006](#)].
 - Serum calcium:
 - This is to identify people with hyperparathyroidism or other conditions associated with hypercalcaemia.
 - If the serum calcium level is high (greater than 2.60 mmol/L), a diagnosis of hyperparathyroidism should be investigated by repeated calcium analyses and assessment of the parathyroid hormone level [[European Association of Urology, 2008](#)].
 - Uric acid:
 - Where it is not possible to analyse the stone, a high serum urate level together with a radiolucent stone supports the suspicion of a uric acid stone [[European Association of Urology, 2008](#)].
- [[European Association of Urology, 2008](#)]

Basis for recommendation

These recommendations are based on expert opinion [[Wright et al, 2002](#); [Tamm et al, 2003](#); [Parmar, 2004](#); [Miller and Lingeman, 2007](#); [European Association of Urology, 2008](#); [Rees, 2008](#); [Stewart and Joyce, 2008](#)].

Fast-track referral

- Rapid referral is recommended for all people with an acute episode of renal colic because appropriate radiological investigations are required [[Tamm et al, 2003](#); [Parmar, 2004](#); [European Association of Urology, 2008](#); [Stewart and Joyce, 2008](#)]:
 - To confirm urolithiasis as the cause of the pain.
 - To identify the location and degree of any obstruction:
 - Obstruction can be a relatively slow and painless process, resulting from a slow stone growth and presenting with advanced renal parenchymal damage [[Bihl and Meyers, 2001](#)].
 - To identify potential complications:
 - Studies have shown that asymptomatic stones in the kidney can (sooner or later) give rise to clinical problems [[European Association of Urology, 2008](#)].

- To determine immediately whether a conservative approach is justified or if another treatment should be considered. About 10–20% of kidney stones need radiological or surgical intervention to remove them [[Parmar, 2004](#)].
- The recommended time frame for referral is based on expert opinion [[Wright et al, 2002](#); [Rees, 2008](#)]. This is supported by feedback from CKS expert reviewers.
- Because of variations in local arrangement and facilities, CKS advises checking local policy or seeking specialist advice regarding the appropriate referral arrangement.

What investigations and treatments are performed in secondary care?

Secondary care investigations

- The clinical diagnosis of acute renal colic should be supported by an appropriate imaging procedure:
 - **Intravenous urography (IVU)** is often the first-line investigation for suspected ureteric stones. It may show the degree of ureteric obstruction, and it is the best technique for defining the pelvicaliceal anatomy. However, it misses some ureteric and renal stones (for example radiolucent stones, which represent 10–20% of stones). It is about 70–90% accurate.
 - **Non-contrast helical computed tomography** has the highest diagnostic accuracy (greater than 95%) and is now the gold standard. It is available in many hospitals, especially those with stone centres. Unlike IVU, it can visualize both radio-opaque and radiolucent stones and does not require the use of intravenous contrast medium. Until recently, availability has been limited, but it is becoming the preferred investigation because of its accuracy. Access and interpretation out-of-hours may be a problem, and the radiation dose is higher than that of limited IVU.
 - **Plain abdominal radiography** of the kidney, ureters, and bladder is a useful adjunct to aid the early diagnosis of renal colic and to monitor the passage of radio-opaque stones (for example in people who are managed conservatively or after extracorporeal shock-wave lithotripsy [ESWL]). Most renal stones contain calcium and should be visible on radiography; however, in practice, bowel gas, extrarenal calcification, and obesity are limiting factors. It has a sensitivity between 45% and 60%.
 - **Ultrasonography** has the advantage of being non-invasive, but its usefulness is limited, as small stones are difficult to diagnose and stones in the ureter are generally not seen. Ultrasonography is appropriate when renal colic occurs in pregnancy, in children, and in febrile people. Reported sensitivities range from 37–64% for stone detection. Ultrasonography is used to diagnose hydronephrosis in people with complicated renal colic.

- **Magnetic resonance urography** is usually considered only if other investigations are contraindicated (such as during pregnancy). The main drawbacks are scanning time and competing imaging priorities.
- **Retrograde ureterography/ureteroscopy** is occasionally necessary if the person has persistent symptoms of renal colic but the result of IVU or non-contrast helical computed tomography is difficult to interpret (for example if there are multiple phleboliths, hip arthroplasties, or poor contrast medium excretion). In practice, this situation is unusual.

Secondary care treatments

- Conservative management may include the use of medical expulsive therapy (MET) to facilitate spontaneous stone passage (off-licence use) during the observation period.
- MET may be indicated for people with adequate renal function reserve who have a newly diagnosed distal ureteric stone (less than 10 mm), whose symptoms are controlled, and who have no clinical evidence of sepsis.
- Although calcium channel blockers (such as nifedipine) have been used for MET, alpha-blockers (such as tamsulosin) are now preferred.
- Stone removal is indicated in the presence of persistent obstruction, failure of stone progression, or increasing or unremitting colic.
- The choice of treatment to remove the stone depends on the size, site, and shape of the stone at initial presentation. The main treatment options are:
 - **ESWL** focuses shock waves on the stone, breaking it up. Stone particles are passed spontaneously. This is a non-invasive outpatient treatment.
 - **Percutaneous nephrolithotomy** is used for stones in the kidney not suitable for ESWL or ureteroscopy. These include cystine stones, stones larger than 2 cm, and staghorn calculi. A nephroscope is passed percutaneously into the collecting system, and the stone is fragmented and extracted through the nephroscope.
 - **Ureteroscopy** with use of laser to break up the stone is a more recently introduced technique with a reported 97–100% success rate. The rate of ureteric injury is low in experienced hands. Various energy sources can be used. Laser or ballistic lithotriptors are preferred.
 - **Stone removal by open surgery** is required in only 1–5% of people in whom ESWL, ureteroscopy, and percutaneous nephrolithotomy have failed or in complicated situations, including complex stone burden, non-functioning kidney, skeletal deformities, severe intrarenal abnormalities, and severe obesity.

Metabolic risk evaluation

- This may be done for people who are considered at high risk of recurrent renal stone so that appropriate preventive measures can be considered.

Basis for recommendation

This information is based on published reviews, studies, and guidance [[Tiselius et al, 2001](#); [Sandhu et al, 2003b](#); [Spencer et al, 2004](#); [Teichman, 2004](#); [Masarani and Dinneen, 2007](#); [European Association of Urology, 2008](#); [Stewart and Joyce, 2008](#)].

- The use of medical expulsive therapy, indications for stone removal, and metabolic risk evaluation are based on guidance issued by the European Association of Urology [[European Association of Urology, 2008](#)].

How likely is it that a renal stone will pass spontaneously?

- The likelihood of spontaneous stone passage will depend on a number of factors including the size of the stone, its location (for example, distal ureteral stones are more likely to pass than proximal ureteral stones) and degree of obstruction.
- Overall, most stones less than 5 mm in diameter will pass spontaneously. Spontaneous passage is less likely for larger stones.
 - Stones less than 5 mm in diameter pass spontaneously in up to 80% of people.
 - Stones between 5 mm and 10 mm in diameter pass spontaneously in about 50% of people. However, stones with a diameter greater than 7 mm have a very low chance of spontaneous passage.
 - Stones larger than 1 cm in diameter usually require intervention (urgent intervention is required if complete obstruction or infection is present).
- Two thirds of stones that pass spontaneously will do so within 4 weeks of the onset of symptoms.
- A stone that has not passed within 1–2 months is unlikely to pass spontaneously.
- [Table 1](#) shows the mean time required for spontaneous passage, and the likelihood of eventual need for elective intervention for stones of different sizes.

Table 1. Likelihood of passage of ureteric stones.

Size of stone	Mean number of days required to pass stone	Likelihood of eventual need for elective intervention
2 mm or less	8 days	3%
3 mm	12 days	14%
4–6 mm	22 days	50%
Greater than 6 mm*	—	99%

* A stone of this size is unlikely to be passed spontaneously.

Data based on results from: [[Hubner et al, 1993](#); [Miller and Kane, 1999](#)]

Data from: [[Teichman, 2004](#)]

Basis for recommendation

This recommendation is based on guideline issued by the European Association of Urology and published expert reviews [[Sandhu et al, 2003b](#); [Teichman, 2004](#); [Masarani and Dinneen, 2007](#); [European Association of Urology, 2008](#)].

- The information on spontaneous passage of renal stones is taken from a published review [[Teichman, 2004](#)], and results of a meta-analysis done by the European Association of Urology and American Urological Association Education and Research for various stone sizes [[European Association of Urology, 2007](#)]. In their analysis, the percentages of people who were stone-free were 68% (46–85%) for stones less than 5 mm (n = 224), and 47% (36–59%) for stones 5–10 mm (n = 104). No data for stones larger than 10 mm was found.
- The data for the mean time for spontaneous passage and the likelihood of elective intervention ([Table 1](#)) are reproduced from a published review [[Teichman, 2004](#)], and are based on results of a retrospective study (n = 2704) [[Hubner et al, 1993](#); [Miller and Kane, 1999](#)], and a prospective study (n = 75) [[Miller and Kane, 1999](#)].

What general advice should I offer to prevent recurrence?

- Increase [fluid intake](#) to produce 2–3 litres of urine each day.
- If compliance is difficult, advise increasing fluid intake to maintain colourless urine. Yellow or brown urine is too concentrated.
- Advise a balanced diet and encourage fruit and vegetable intake.
- For people with calcium stones (responsible for 60–80% of kidney stones):

- Avoid excessive dietary intake of:
- Oxalate-rich products, such as rhubarb, spinach, cocoa, tea leaves, and nuts (see [Additional information](#) for content).
- Animal protein — limit intake to 0.8–1.0 g/kg body weight.
- Sodium — do not exceed 3 g daily.
- Urate-rich products, such as liver, kidney, calf thymus, poultry skin, and certain fish (herring with skin, sardines, anchovies, and sprats, see [Additional information](#) for content).
- Do not restrict dietary calcium intake, but avoid the use of calcium supplements.

Additional information

- **Fluid intake:**

- A review found conflicting data from clinical and epidemiological studies on the effect of various drinks on the risk of stone formation [[Siener and Hesse, 2003](#)].
- There is limited [evidence](#) from one small study which found increased water intake (to produce urine output of 2 litres or more daily) can help to reduce stone recurrence [[Borghi et al, 1996](#)].
- The European Association of Urology advised that most drinks can be taken to increase fluid intake and to help prevent stone formation; however, grapefruit juice has been associated with an increased risk of stone formation [[European Association of Urology, 2008](#)].

- **Products with high oxalate content are:**

- Rhubarb: 530 mg oxalate/100 g.
- Spinach: 570 mg oxalate/100 g.
- Cocoa: 625 mg oxalate/100 g.
- Tea leaves: 375–1450 mg oxalate/100 g.
- Nuts: 200–600 mg oxalate/100 g.
- Other foods with high oxalate content include soy products, strawberries, and wheat bran [[Finkelstein and Goldfarb, 2006](#)].

- **Products with high urate content are:**

- Calf thymus: 900 mg urate/100 g.
- Liver: 260–360 mg urate/100 g.
- Kidneys: 210–255 mg urate/100 g.
- Poultry skin: 300 mg urate/100 g.
- Herring with skin, sardines, anchovies, and sprats: 260–500 mg urate/100 g.
- The European Association of Urology recommends that urate intake should not exceed 500 mg per day for people with hyperuricosuric calcium oxalate stone disease or uric acid stone disease.

[[European Association of Urology, 2008](#)]

Basis for recommendation

These recommendations are based on guidance issued by the European Association of Urology [[European Association of Urology, 2008](#)].

Preventive measures

- These are important because the risk of stone recurrence is high.
- The process of stone formation depends on: urinary volume; urinary concentrations of calcium, phosphate, oxalate, sodium, and uric acid ions; urinary concentrations of natural calculus inhibitors (such as citrate and magnesium); and urinary pH [[Pietrow and Karellas, 2006](#)].
- Consequently, the aims of preventive measures are:
 - To promote factors which reduce stone formation (such as increasing urinary volume), *and*
 - To reduce risk factors for stone formation (such as oxalate, urate, and sodium intake).

Increased fluid intake

- An inverse relationship between high fluid intake and stone formation has been demonstrated [[European Association of Urology, 2008](#)]. A higher fluid intake increases diuresis and dilutes the urine, reducing the risk of crystallization.
- There is limited [evidence](#) from one small 5-year prospective study which found increased water intake (to produce urine output of 2 litres or more daily) can help to reduce stone recurrence [[Borghetti et al., 1996](#)].

- Although a urine output of 2–3 litres per day is generally recommended for all people with stone disease, long-term compliance may be difficult. Consequently, some experts recommend an increased fluid intake to maintain a colourless urine to aid compliance [[Teichman, 2004](#); [Reynolds, 2005](#)].

Dietary measures

- These recommendations are based on expert opinion and are aimed to reduce excessive dietary intake of oxalate, urate, sodium, and animal protein (all of which are associated with increased stone formation) [[European Association of Urology, 2008](#)].
- Dietary intake of calcium should not be restricted because of the inverse relationship between dietary calcium and calcium stone formation [[European Association of Urology, 2008](#)]. Dietary calcium is thought to bind to oxalate in the gut, preventing its absorption [[Reynolds, 2005](#)]. Paradoxically, supplementary calcium has been found to increase stone formation and is therefore not recommended [[Reynolds, 2005](#)].

Prescriptions

For information on contraindications, cautions, drug interactions, and adverse effects, see the electronic Medicines Compendium (eMC) (<http://emc.medicines.org.uk>), or the British National Formulary (BNF) (www.bnf.org).

Parenteral analgesics for severe renal colic

Age from 16 years onwards

Diclofenac 75mg intramuscular injection

Diclofenac 75mg/3ml solution for injection ampoules

Give 3ml (75mg) by deep intramuscular injection into the upper outer quadrant of the gluteal muscle.

Supply 1 ampoule.

Age: from 16 years onwards

NHS cost: £0.83

Licensed use: yes

Diamorphine 1.25-2.5mg by slow intravenous injection

Diamorphine 5mg powder for solution for injection ampoules

Give 1.25mg to 2.5mg by slow intravenous injection

Supply 1 ampoule.

Age: from 16 years onwards

NHS cost: £2.69

Licensed use: yes

Patient information: Prescription writing requirements apply.

Diamorphine 2.5mg s/c or i/v injection: frail or elderly

Diamorphine 5mg powder for solution for injection ampoules

Give 2.5mg by subcutaneous or intravenous injection.

Supply 1 ampoule.

Age: from 16 years onwards
NHS cost: £2.69
Licensed use: yes

Patient information: Prescription requirements apply.

Diamorphine 5mg subcutaneous or intramuscular injection

Diamorphine 5mg powder for solution for injection ampoules
Give 5mg by subcutaneous or intramuscular injection.
Supply 1 ampoule.

Age: from 16 years onwards
NHS cost: £2.69
Licensed use: yes

Patient information: Prescription requirements apply.

Parenteral anti-emetics

Age from 16 years onwards

Cyclizine 50mg intramuscular injection

Cyclizine 50mg/1ml solution for injection ampoules
Give 1ml (50mg) by intramuscular injection.
Supply 1 ampoule.

Age: from 16 years onwards
NHS cost: £0.49
Licensed use: yes

Prochlorperazine 12.5mg intramuscular injection

Prochlorperazine 12.5mg/1ml solution for injection ampoules
Give 1ml (12.5mg) by deep intramuscular injection.
Supply 1 ampoule.

Age: from 16 years onwards
NHS cost: £0.54
Licensed use: yes

Age from 20 years onwards

Metoclopramide 10mg intramuscular injection

Metoclopramide 10mg/2ml solution for injection ampoules
Give 2ml (10mg) by intramuscular injection.
Supply 1 ampoule.

Age: from 20 years onwards
NHS cost: £0.26
Licensed use: yes

Diclofenac: tablets and suppositories

Age from 16 years onwards

Diclofenac sodium e/c tablets: 25mg three times a day

Diclofenac sodium 25mg gastro-resistant tablets
Take one tablet three times a day.

Supply 21 tablets.

Age: from 16 years onwards
NHS cost: £0.30
Licensed use: yes

Diclofenac sodium e/c tablets: 50mg three times a day

Diclofenac sodium 50mg gastro-resistant tablets
Take one tablet three times a day.
Supply 21 tablets.

Age: from 16 years onwards
NHS cost: £0.51
Licensed use: yes

Diclofenac suppository: 25mg when required, max 3 in 24 hours

Diclofenac 25mg suppositories
Insert one suppository into the rectum when required for pain relief. Maximum of 3 suppositories in 24 hours.
Supply 10 suppositories.

Age: from 16 years onwards
NHS cost: £1.26
Licensed use: yes

Diclofenac suppository: 50mg when required, max 3 in 24 hours

Diclofenac 50mg suppositories
Insert one suppository into the rectum when required for pain relief. Maximum of 3 suppositories in 24 hours.
Supply 10 suppositories.

Age: from 16 years onwards
NHS cost: £2.07
Licensed use: yes

Paracetamol +/- weak opioid

Age from 16 years onwards

Paracetamol tablets: 1g up to four times a day if required

Paracetamol 500mg tablets
Take two tablets every 4 to 6 hours when required for pain relief. Maximum of 8 tablets in 24 hours.
Supply 50 tablets.

Age: from 16 years onwards
NHS cost: £0.78
OTC cost: £1.38
Licensed use: yes

Add on if severe pain: codeine 30-60mg 4-6 hourly if needed

Codeine 30mg tablets
Take one to two tablets every 4 to 6 hours when required for additional pain relief. Maximum of 8 tablets in 24 hours.
Supply 28 tablets.

Age: from 16 years onwards
NHS cost: £1.19

Licensed use: yes

Add on if severe pain: tramadol 50-100mg 4 hourly if needed

Tramadol 50mg capsules

Take one to two capsules every four hours if required. Do not take more than eight in 24 hours.

Supply 30 Capsules.

Age: from 16 years onwards

NHS cost: £1.28

Licensed use: yes

Anti-emetics: oral and rectal preparations

Age from 16 years onwards

Cyclizine tablets: 50mg three times a day when required

Cyclizine 50mg tablets

Take one tablet up to three times a day when required for sickness.

Supply 20 tablets.

Age: from 16 years onwards

NHS cost: £1.48

Licensed use: yes

Prochlorperazine tablets: 5-10mg three times a day

Prochlorperazine 5mg tablets

Take one to tablets two to three times a day if required to prevent sickness.

Supply 21 tablets.

Age: from 16 years onwards

NHS cost: £1.31

Licensed use: yes

Domperidone tablets: 10-20mg every 6-8 hours

Domperidone 10mg tablets

Take one to two tablets every 6 to 8 hours when required for relief of nausea and vomiting. Do not take more than 8 tablets in 24 hours.

Supply 30 tablets.

Age: from 16 years onwards

NHS cost: £2.10

Licensed use: yes

Domperidone suppositories: 60mg twice daily if required

Domperidone 30mg suppositories

Insert two suppositories into the rectum twice a day when required for the relief of sickness. Maximum of 4 suppositories in 24 hours.

Supply 10 suppositories.

Age: from 16 years onwards

NHS cost: £3.18

Licensed use: yes

Age from 20 years onwards

Metoclopramide tablets: 10mg up to three times a day

Metoclopramide 10mg tablets

Take one tablet up to three times a day when required for the relief of sickness.

Supply 21 tablets.

Age: from 20 years onwards

NHS cost: £0.92

Licensed use: yes