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- Συνολική ποιότητα του άρθρου
- Σημασία του άρθρου από κλινικής άποψης
- Σημασία του άρθρου για περαιτέρω έρευνα πάνω στο αντικείμενο της λιθίασης

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European Association of Urology

Platinum Priority – Guidelines

Editorial by Matthew Bultitude, Daron Smith and Kay Thomas on pp. 483–484 of this issue

EAU Guidelines on Diagnosis and Conservative Management of Urolithiasis

Christian Türk [a], *Aleš Petřík* [b,c], *Kemal Sarica* [d], *Christian Seitz* [e], *Andreas Skolarikos* [f], *Michael Straub* [g], *Thomas Knoll* [h,*]

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Abstract

Context: Low-dose computed tomography (CT) has become the first choice for detection of ureteral calculi. Conservative observational management of renal stones is possible, although the availability of minimally invasive treatment often leads to active treatment. Acute renal colic due to ureteral stone obstruction is an emergency that requires immediate pain management. Medical expulsive therapy (MET) for ureteral stones can support spontaneous passage in the absence of complicating factors. These guidelines summarise current recommendations for imaging, pain management, conservative treatment, and MET for renal and ureteral stones. Oral chemolysis is an option for uric acid stones.
Objective: To evaluate the optimal measures for diagnosis and conservative and medical treatment of urolithiasis.
Evidence acquisition: Several databases were searched for studies on imaging, pain management, observation, and MET for urolithiasis, with particular attention to the level of evidence.
Evidence synthesis: Most patients with urolithiasis present with typical colic symptoms, but stones in the renal calices remain asymptomatic. Routine evaluation includes ultrasound imaging as the first-line modality. In acute disease, low-dose CT is the method of choice. Ureteral stones <6 mm can pass spontaneously in well-controlled patients. Sufficient pain management is mandatory in acute renal colic. MET, usually with α-receptor antagonists, facilitates stone passage and reduces the need for analgesia. Contrast imaging is advised for accurate determination of the renal anatomy. Asymptomatic calyceal stones may be observed via active surveillance.
Conclusions: Diagnosis, observational management, and medical treatment of urinary calculi are routine measures. Diagnosis is rapid using low-dose CT. However, radiation exposure is a limitation. Active treatment might not be necessary, especially for stones in the lower pole. MET is recommended to support spontaneous stone expulsion.

Table 4 – The role of NCCT in diagnostic imaging.

Evidence summary	LE
If NCCT is indicated in patients with BMI <30 kg/m^2, use a low-dose technique	1b
NCCT allows measurement of stone density and skin-to-stone distance	

LE = level of evidence; NCCT = non–contrast-enhanced computed tomography; BMI = body mass index.

LOW-DOSE NCCT

Σε ασθενείς με BMI < $30 Kg/m^2$

Έχει ευαισθησία 86% για ουρητηρικούς λίθους <3mm και 100% για λίθους >3mm

Table 14 – Recommendation for the conservative management of ureteral calculi.

Recommendation	LE	GR
In patients with newly diagnosed ureteral stones <6 mm [a], if active removal is not indicated, observation with periodic evaluation is an optional initial treatment	1a	A
Such patients may be offered appropriate medical therapy to facilitate stone passage during observation		

LE = level of evidence; GR = grade of recommendation, MET = medical expulsive therapy.

[a] The exact cutoff size for ureteral stones cannot be determined from the literature, but the panel suggests <6 mm.

Table 16 – Recommendations on MET to facilitate spontaneous passage of urinary calculi.

Recommendation	LE	GR
For MET, α-blockers are recommended	1a	A
Patients should be counselled about the attendant risks of MET, including associated drug side effects, and should be informed that it is administered off-label [a]	4	A*
Patients who elect for an attempt at spontaneous passage or MET should have well-controlled pain, no clinical evidence of sepsis, and adequate renal functional reserve	4	A
Patients should be followed once between 1 and 14 d to monitor stone position and be assessed for hydronephrosis	4	A*

LE = level of evidence; GR = grade of recommendation; MET = medical expulsive therapy.

[a] It is not known if tamsulosin harms the human foetus or if it is found in breast milk.

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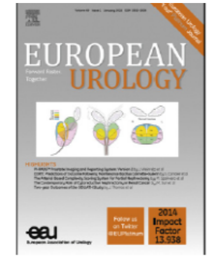

European Association of Urology

Platinum Priority – Guidelines

Editorial by Matthew Bultitude, Daron Smith and Kay Thomas on pp. 483–484 of this issue

EAU Guidelines on Interventional Treatment for Urolithiasis

Christian Türk[a], *Aleš Petřík*[b,c], *Kemal Sarica*[d], *Christian Seitz*[e], *Andreas Skolarikos*[f], *Michael Straub*[g], *Thomas Knoll*[h,*]

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Laparoscopy
Stenting
Residual fragments

Abstract

Context: Management of urinary stones is a major issue for most urologists. Treatment modalities are minimally invasive and include extracorporeal shockwave lithotripsy (SWL), ureteroscopy (URS), and percutaneous nephrolithotomy (PNL). Technological advances and changing treatment patterns have had an impact on current treatment recommendations, which have clearly shifted towards endourologic procedures. These guidelines describe recent recommendations on treatment indications and the choice of modality for ureteral and renal calculi.

Objective: To evaluate the optimal measures for treatment of urinary stone disease.

Evidence acquisition: Several databases were searched to identify studies on interventional treatment of urolithiasis, with special attention to the level of evidence.

Evidence synthesis: Treatment decisions are made individually according to stone size, location, and (if known) composition, as well as patient preference and local expertise. Treatment recommendations have shifted to endourologic procedures such as URS and PNL, and SWL has lost its place as the first-line modality for many indications despite its proven efficacy. Open and laparoscopic techniques are restricted to limited indications. Best clinical practice standards have been established for all treatments, making all options minimally invasive with low complication rates.

Conclusion: Active treatment of urolithiasis is currently a minimally invasive intervention, with preference for endourologic techniques.

Table 1 – Recommendations for active treatment of renal calculi

Recommendation	GR
SWL and endourology (PNL and URS) are treatment options for renal stones <2 cm	B
Stones >2 cm should be treated by PNL	A
Flexible URS is a possible second-line treatment for large stones (>2 cm) but SFRs are lower and staged procedures may be required	B
PNL or flexible URS is recommended for the lower pole, even for stones >1.5 cm, because SWL efficacy is limited	B

GR = grade of recommendation; PNL = percutaneous nephrolithotomy; SFR = stone-free rate; SWL = extracorporeal shock wave lithotripsy; URS = ureteroscopy.

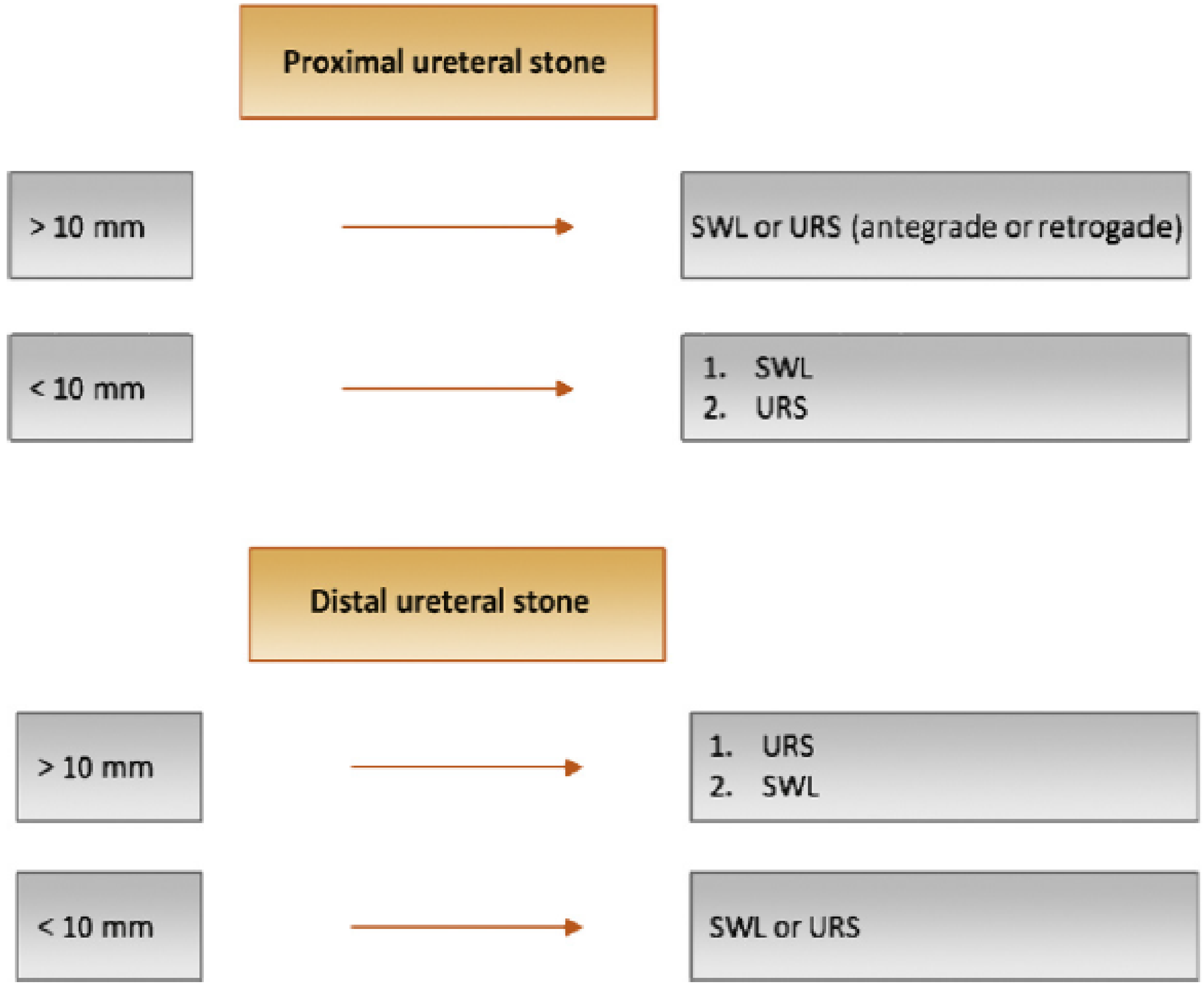
Proximal ureteral stone
> 10 mm
SWL or URS (antegrade or retrogade)
< 10 mm
1. SWL
2. URS
Distal ureteral stone
> 10 mm
1. URS
2. SWL
< 10 mm
SWL or URS

Table 6 – Recommendations for assessing stone composition before treatment

Recommendations	LE	GR
The stone composition should be evaluated before deciding on the method of removal (based on patient history, prior stone analysis for the patient or HU in unenhanced computed tomography)	2a	B
In stones with a medium density >1000 HU, SWL is not recommended since disintegration will be less likely	1	A
In uric acid stones, chemolysis can be considered	2a	B

HU = Hounsfield units; GR = grade of recommendation; LE = level of evidence; SWL = extracorporeal shock wave lithotripsy.

Surgical Management of Stones: American Urological Association/Endourological Society Guideline, PART I

Dean Assimos, Amy Krambeck, Nicole L. Miller, Manoj Monga, M. Hassan Murad, Caleb P. Nelson, Kenneth T. Pace, Vernon M. Pais, Jr., Margaret S. Pearle, Glenn M. Preminger, Hassan Razvi, Ojas Shah and Brian R. Matlaga

From the American Urological Association Education and Research, Inc., Linthicum, Maryland

Purpose: This Guideline is intended to provide a clinical framework for the surgical management of patients with kidney and/or ureteral stones. The summary presented herein represents Part I of the two-part series dedicated to Surgical Management of Stones: American Urological Association/Endourological Society Guideline. Please refer to Part II for an in-depth discussion of patients presenting with ureteral or renal stones.

Materials and Methods: A systematic review of the literature (search dates 1/1/1985 to 5/31/2015) was conducted to identify peer-reviewed studies relevant to the surgical management of stones. The review yielded an evidence base of 1,911 articles after application of inclusion/exclusion criteria. These publications were used to create the Guideline statements. Evidence-based statements of Strong, Moderate, or Conditional Recommendation were developed based on benefits and risks/burdens to patients. Additional directives are provided as Clinical Principles and Expert Opinions when insufficient evidence existed.

Results: The Panel identified 12 adult Index Patients to represent the most common cases seen in clinical practice. Three additional Index Patients were also created to describe pediatric and pregnant patients with such stones. With these patients in mind, Guideline statements were developed to aid the clinician in identifying optimal management.

Conclusions: Proper treatment selection, which is directed by patient- and stone-specific factors, remains the greatest predictor of successful treatment outcomes. This Guideline is intended for use in conjunction with the individual patient's treatment goals. In all cases, patient preferences and personal goals should be considered when choosing a management strategy.

Key Words: nephrolithiasis; ureteroscopy; nephrostomy, percutaneous

Abbreviations and Acronyms

AUA = American Urological Association

CBC = complete blood count

CT = computerized tomography

MET = medical expulsive therapy

PCNL = percutaneous nephrolithotomy

SWL = shock-wave lithotripsy

UPJ = ureteropelvic junction

URS = ureteroscopy

UTI = urinary tract infection

Accepted for publication May 23, 2016.

The complete guideline is available at http://www.auanet.org/common/pdf/education/clinical-guidance/Surgical-Management-of-Stones.pdf.

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Imaging, Preoperative Testing. 1. **Clinicians should obtain a non-contrast CT scan on patients prior to performing PCNL. (Strong Recommendation; Evidence Strength: Grade C)**

The use of computerized tomography for preoperative assessment in those with nephrolithiasis prior to performance of percutaneous nephrolithotomy has gained widespread acceptance as it defines stone burden and distribution and provides information regarding collecting system anatomy, position of peri-renal structures and relevant anatomic variants. It may also be used to predict

2. Clinicians may obtain a non-contrast CT scan to help select the best candidate for SWL versus URS. (Conditional Recommendation; Evidence Strength: Grade C)

The Panel recognizes that multiple imaging modalities may be used to preoperatively assess candidates for shock-wave lithotripsy (SWL) and ureteroscopy (URS).[9] However, in light of the breadth of information provided by CT, the Panel feels that CT can be useful to help determine whether SWL or URS is better suited for a given patient.

4. **Clinicians are required to obtain a urinalysis prior to intervention. In patients with clinical or laboratory signs of infection, urine culture should be obtained. (Strong Recommendation; Evidence Strength: Grade B)**

It is critical that clinicians obtain a urinalysis prior to stone intervention in order to minimize the risks of infectious complications. A urine culture should be obtained if urinary tract infection is suspected based on the urinalysis or clinical findings. If the culture demonstrates infection, the patient should be prescribed appropriate antibiotic therapy.

6. In patients with complex stones or anatomy, clinicians may obtain additional contrast imaging if further definition of the collecting system and the ureteral anatomy is needed. (Conditional recommendation; Evidence Strength: Grade C)

Situations in which complex urinary tract anatomy may require further imaging include ectopic kidneys (e.g., horseshoe kidney, pelvic kidney, cross-fused ectopia), other congenital kidney conditions (e.g., ureteropelvic junction obstruction, duplicated collecting system, caliceal diverticulum, ureteral stricture, megaureter, ureterocele), renal transplant grafts, kidneys with prior surgery or complex stone anatomy/conditions (e.g., staghorn stones, nephrocalcinosis).

23. When residual fragments are present, clinicians should offer patients endoscopic procedures to render the patients stone-free, especially if infection stones are suspected.

(Index Patient 11) (Moderate Recommendation; Evidence Strength: Grade C)

In a retrospective analysis of the natural history of residual fragments following PCNL, 43% patients experienced a stone-related event at a median of 32 months.[11] Similarly, in a recent report by the EDGE Research Consortium evaluating patients with residual fragments following URS, 15% of patients developed a complication requiring no intervention, and an additional 29% of patients required intervention for residual fragments.[12]

The Panel advocates for the removal of suspected infection stones or infected stone fragments to limit the possibility of further stone growth, recurrent UTI, and renal damage.

41. If initial SWL fails, clinicians should offer endoscopic therapy as the next treatment option. (Index Patients 1-14) (Moderate Recommendation; Evidence Strength: Grade C)

If initial SWL fails, it is important to re-evaluate the stone characteristics (e.g., size, location, density, composition) and patient characteristics (e.g., obesity, collecting system anatomy including an obstructed system) that may have contributed to the initial failure. Success may be stratified such that those who have had partial fragmentation and clearance may be considered for repeat SWL while those with no fragmentation and/or clearance may be selected specifically for endoscopic intervention. Success rates for PCNL and URS as secondary procedures after failed SWL are reported as 86-100% and 62-100%, respectively.[14]

Surgical Management of Stones: American Urological Association/Endourological Society Guideline, PART II

Dean Assimos, Amy Krambeck, Nicole L. Miller, Manoj Monga, M. Hassan Murad, Caleb P. Nelson, Kenneth T. Pace, Vernon M. Pais, Jr., Margaret S. Pearle, Glenn M. Preminger, Hassan Razvi, Ojas Shah and Brian R. Matlaga

From the American Urological Association Education and Research, Inc., Linthicum, Maryland

Purpose: This Guideline is intended to provide a clinical framework for the surgical management of patients with kidney and/or ureteral stones. The summary presented herein represents Part II of the two-part series dedicated to Surgical Management of Stones: American Urological Association/ Endourological Society Guideline. Please refer to Part I for introductory information and a discussion of pre-operative imaging and special cases.

Materials and Methods: A systematic review of the literature (search dates 1/1/1985 to 5/31/2015) was conducted to identify peer-reviewed studies relevant to the surgical management of stones. The review yielded an evidence base of 1,911 articles after application of inclusion/exclusion criteria. These publications were used to create the Guideline statements. Evidence-based statements of Strong, Moderate, or Conditional Recommendation were developed based on benefits and risks/burdens to patients. Additional directives are provided as Clinical Principles and Expert Opinions when insufficient evidence existed.

Results: The Panel identified 12 adult Index Patients to represent the most common cases seen in clinical practice. Three additional Index Patients were also created to describe the more commonly encountered special cases, including pediatric and pregnant patients. With these patients in mind, Guideline statements were developed to aid the clinician in identifying optimal management.

Conclusions: Proper treatment selection, which is directed by patient- and stone-specific factors, remains the greatest predictor of successful treatment outcomes. This Guideline is intended for use in conjunction with the individual patient's treatment goals. In all cases, patient preferences and personal goals should be considered when choosing a management strategy.

Key Words: nephrolithiasis; ureteroscopy; nephrostomy, percutaneous

Abbreviations and Acronyms

EHL = electrohydraulic lithotripsy

MET = medical expulsive therapy

PCNL = percutaneous nephrolithotomy

SWL = shock-wave lithotripsy

URS = ureteroscopy

Accepted for publication May 23, 2016.

The complete guideline is available at http://www.auanet.org/common/pdf/education/clinical-guidance/Surgical-Management-of-Stones.pdf.

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GUIDELINE STATEMENTS

Treatment of Adult Patients with Ureteral Stones. 7. **Patients with uncomplicated ureteral stones ≤10 mm should be offered observation, and those with distal stones of similar size should be offered MET with α-blockers. (Index Patient 3) (Strong Recommendation; Evidence Strength: Grade B)**

Natural history studies have shown that the likelihood of spontaneous stone passage correlates with stone size and location.[1] Several pharmacologic agents for medical expulsive therapy, including α_1 receptor

14. **Following URS, clinicians may omit ureteral stenting in patients meeting all of the following criteria: those without suspected ureteric injury during URS, those without evidence of ureteral stricture or other anatomical impediments to stone fragment clearance, those with a normal contralateral kidney, those without renal functional impairment, and those in whom a secondary URS procedure is not planned. (Index Patients 1-6) (Strong Recommendation; Evidence Strength: Grade A)**

Based on the best available evidence, a selective approach to stent placement seems the most prudent strategy for patients undergoing URS.[8] Stent placement should be strongly considered in patients who sustain a ureteral injury during URS, have evidence of anatomical impediment to stone fragment clearance such as ureteral wall edema, have a large initial stone burden (>1.5 cm), have an anatomically or functionally solitary kidney or renal functional impairment, and for whom another ipsilateral URS is likely.

15. **Placement of a ureteral stent prior to URS should not be performed routinely. (Index Patients 1-6) (Strong Recommendation; Evidence Strength: Grade B)**

Despite an association in retrospective studies between pre-stenting and higher stone-free rates or shorter operative time,[9–11] in the absence of prospective data and high level evidence, the Panel recommends against systematic routine stent placement prior to URS when the sole purpose is to enhance stone-free rates or reduce operative times.

18. **Clinicians performing URS for proximal ureteral stones should have a flexible ureteroscope available. (Index Patients 1, 4) (Clinical Principle)**

The limitations of semi-rigid URS in accessing stones in the middle and proximal ureter are overcome by flexible URS. Flexible URS has been shown in both prospective and retrospective studies to have high overall success rates with low morbidity/complications for <2 cm proximal ureteral stones.[18]

22. **In symptomatic patients with a total renal stone burden >20 mm, clinicians should offer PCNL as first-line therapy. (Index Patient 8) (Strong Recommendation; Evidence Strength: Grade C)**

PCNL offers a higher stone-free rate than SWL or URS and is less invasive than open surgery or laparoscopic/robotic assisted procedures. In a RCT comparing PCNL to URS for >2 cm renal pelvic stones, the stone-free rate was higher for PCNL compared to URS (94% versus 75%), although predominantly semi-rigid URS was used in this study.[23] Furthermore, the success rate of PCNL is less dependent on stone composition, density and location.

31. **Clinicians should not offer SWL as first-line therapy to patients with >10 mm lower pole stones. (Index Patient 10) (Strong Recommendation; Evidence Strength: Grade B)**

Endoscopic approaches in this patient population offer substantial benefit over SWL with regard to stone-free rate with a moderate associated increase in risk.[2] For lower pole stones 10-20 mm in size, the median success rate for SWL was 58% compared to 81% for URS and 87% for PCNL. When the stone burden exceeded 20mm, the median success rate of SWL declined to 10%.

34. **Flexible nephroscopy should be a routine part of standard PCNL. (Strong Recommendation; Evidence Strength: Grade B)**

Stone fragmentation (intracorporeal lithotripsy) is commonly performed during PCNL for large stones, and the fragments generated may migrate into areas of the collecting system that cannot be safely accessed with a rigid nephroscope. If not removed, these fragments may result in future stone events.[29–31] The utilization of flexible nephroscopy during PCNL has been demonstrated to improve stone-free rates.[32]

45. **Staghorn stones should be removed if attendant comorbidities do not preclude treatment. (Clinical Principle)**

The Panel endorses stone removal in patients who are able to tolerate the rigors of long and perhaps multiple procedures and their attendant risks.

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Do stones still kill? An analysis of death from stone disease 1999–2013 in England and Wales

Francesca Kum, Wasim Mahmalji, Jemma Hale, Kay Thomas, Matthew Bultitude and Jonathan Glass

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Objectives

To analyse the trends in the number of deaths attributable to urolithiasis in England and Wales over the past 15 years (1999–2013). Urolithiasis has an estimated lifetime risk of 12% in males and 6% in females and is not perceived as a life-threatening pathology. Admissions with urinary calculi contribute to 0.5% of all inpatient hospital stays, and the number of deaths attributable to stone disease has yet to be identified and presented.

Materials and Methods

Office of National Statistics data relating to causes of death from urolithiasis, coded as International Classification of Diseases (ICD)-10 N20–N23, was collated and analysed for the 15-year period from 1999 to 2013 in England and Wales. These data were sub-categorised into anatomical location of calculi, age, and gender.

Results

In all, 1954 deaths were attributed to urolithiasis from 1999 to 2013 (mean 130.3 deaths/year). Of which, 141 were attributed to ureteric stones (mean 9.4 deaths/year). Calculi of the kidney and ureter accounted for 91% of all deaths secondary to urolithiasis; lower urinary tract (bladder or urethra) calculi contributed to only 7.9% of deaths. The data revealed an overall increasing trend in mortality from urolithiasis over this 15-year period, with an increase of 3.8 deaths/year based on a linear trend ($R^2 = 0.65$). Overall, the number of deaths in females was significantly higher than in males (ratio 1.5:1, $P < 0.001$); kidney and ureteric calculi causing death had a female preponderance (1.7:1, female:male); whereas calculi of the lower urinary tract was more common in males (1:2.2, female:male).

Conclusions

Stone disease still causes death in the 21st century in England and Wales. This trend of increasing deaths must be placed in the context of the concurrent rising incidence of urolithiasis in the UK and the number of stone-related hospital episodes. The primary cause of death relating to complications of stone disease for each individual case should be further investigated to facilitate prevention of complications of urolithiasis.

Keywords

epidemiology, urolithiasis, urinary calculi, mortality, sepsis

Fig. 2 Proportion of deaths by anatomical location of stone.

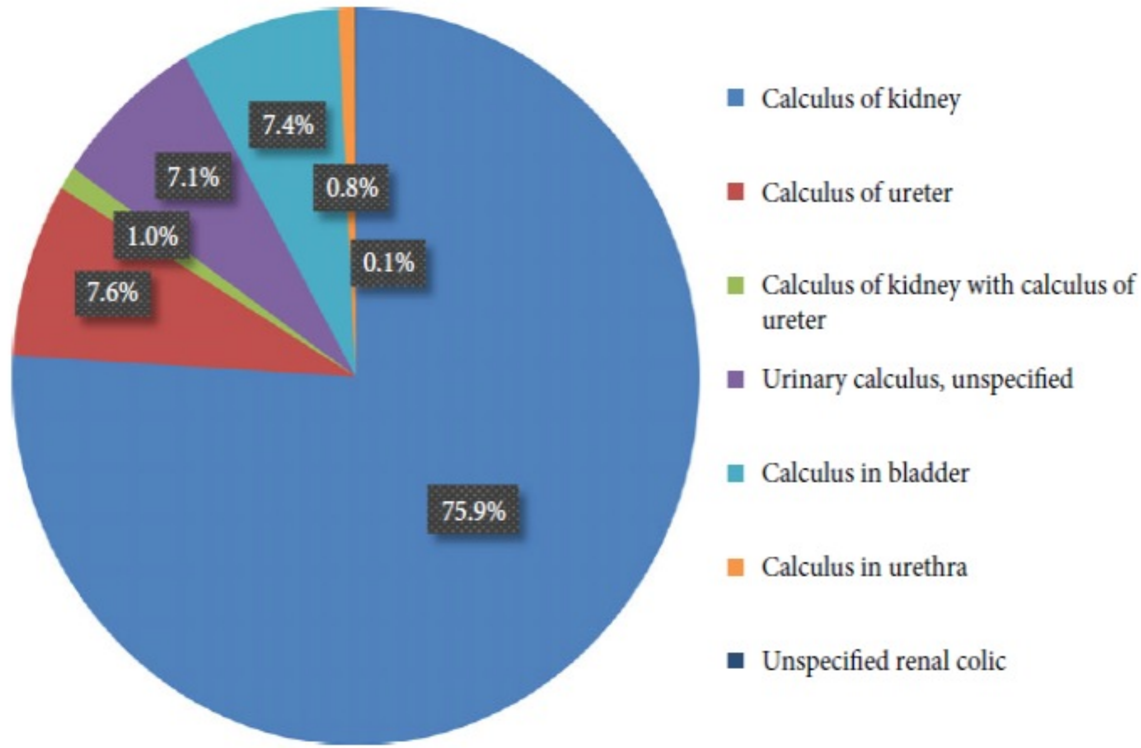


Fig. 3 Number of deaths due to urolithiasis by year, with linear trend (R^2 = 0.65).

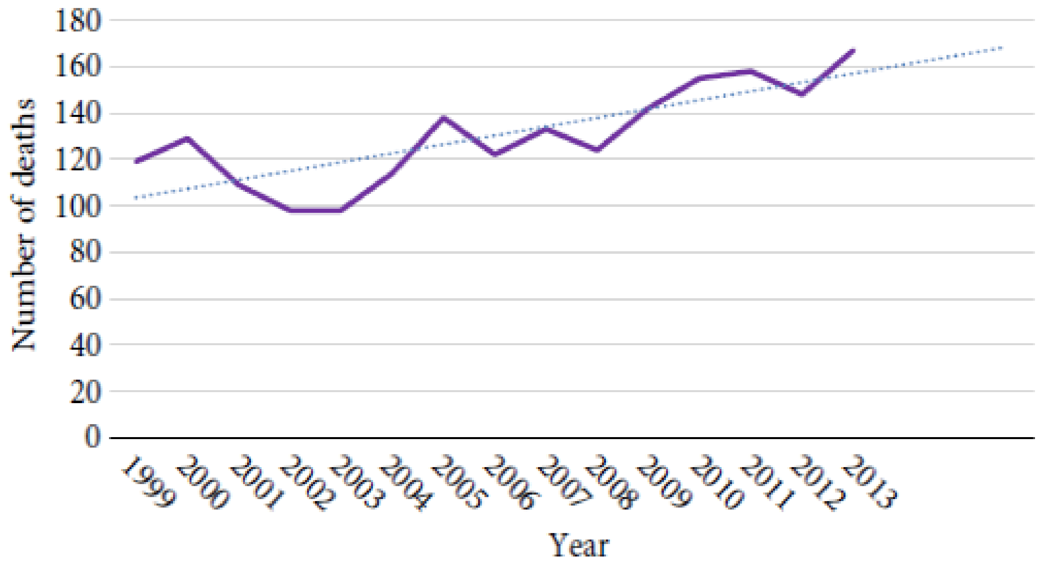
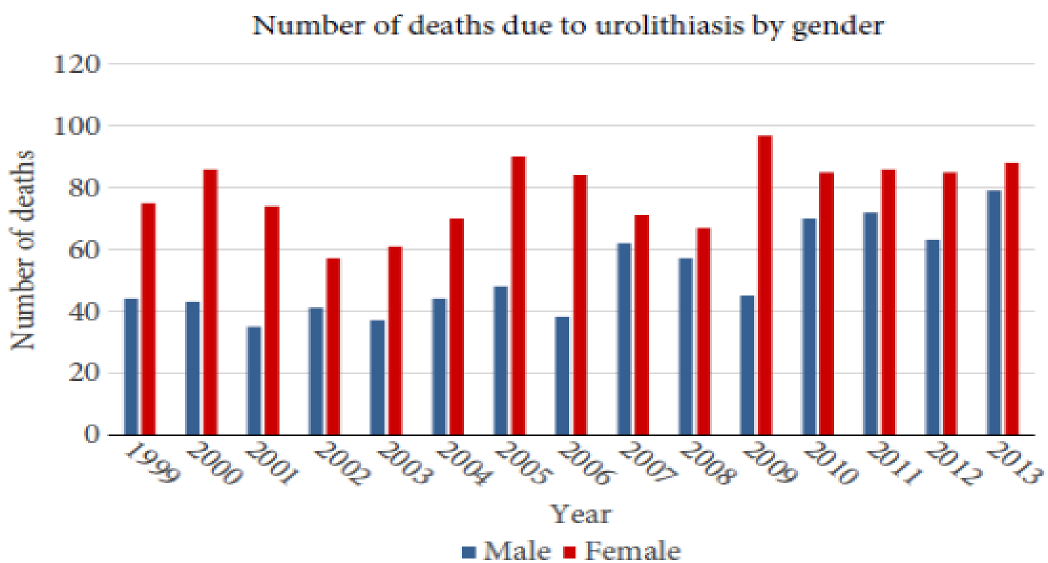


Fig. 1 Absolute numbers of deaths attributable to urolithiasis by year and gender (**a**), graphical representation (**b**).

Year	M	F	Total (M+F)
1999	44	75	119
2000	43	86	129
2001	35	74	109
2002	41	57	98
2003	37	61	98
2004	44	70	114
2005	48	90	138
2006	38	84	122
2007	62	71	133
2008	57	67	124
2009	45	97	142
2010	70	85	155
2011	72	86	158
2012	63	85	148
2013	79	88	167



Medication Nonadherence and Effectiveness of Preventive Pharmacological Therapy for Kidney Stones

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Abbreviations and Acronyms

ED = emergency department

PDC = proportion of days covered

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The corresponding author certifies that, when applicable, a statement(s) has been included in the manuscript documenting institutional review board, ethics committee or ethical review board study approval; principles of Helsinki Declaration were followed in lieu of formal ethics committee approval; institutional animal care and use committee approval; all human subjects provided written informed consent with guarantees of confidentiality; IRB approved protocol number; animal approved project number.

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Purpose: Among patients with kidney stones rates of adherence to thiazide diuretics, alkali citrate therapy and allopurinol, collectively referred to as preventive pharmacological therapy, are low. This lack of adherence may reduce the effectiveness of secondary prevention efforts, leading to poorer clinical health outcomes in patients with kidney stones. To examine the impact that medication nonadherence has on the secondary prevention of kidney stones, we compared clinical health outcomes between patients who adhered to their regimen and those who did not.

Materials and Methods: Using medical and pharmacy claims data we identified adult patients with a physician coded diagnosis for kidney stones. Among the subset with a prescription fill for a preventive pharmacological therapy agent, we then measured adherence to therapy within the first 6 months of initiating treatment using the proportion of days covered formula. We defined adherence as a proportion of days covered value of 80% or greater. Finally, we fitted multivariable logistic regression models to examine the association between medication adherence and the occurrence of a stone related clinical health outcome (an emergency department visit, hospitalization or surgery for stone disease).

Results: Of the 8,950 patients who met the study eligibility criteria slightly more than half (51.1%) were adherent to preventive pharmacological therapy. The frequency of emergency department visits, hospitalization and surgery for stone disease was significantly lower among adherent patients. After controlling for sociodemographic factors and the level of comorbid illness, patients who were adherent to therapy had 27% lower odds of an emergency department visit (OR 0.73, 95% CI 0.64–0.84), 41% lower odds of hospital admission (OR 0.59, 95% CI 0.49–0.71) and 23% lower odds of surgery for stone disease (OR 0.77, 95% CI 0.69–0.85) than nonadherent patients.

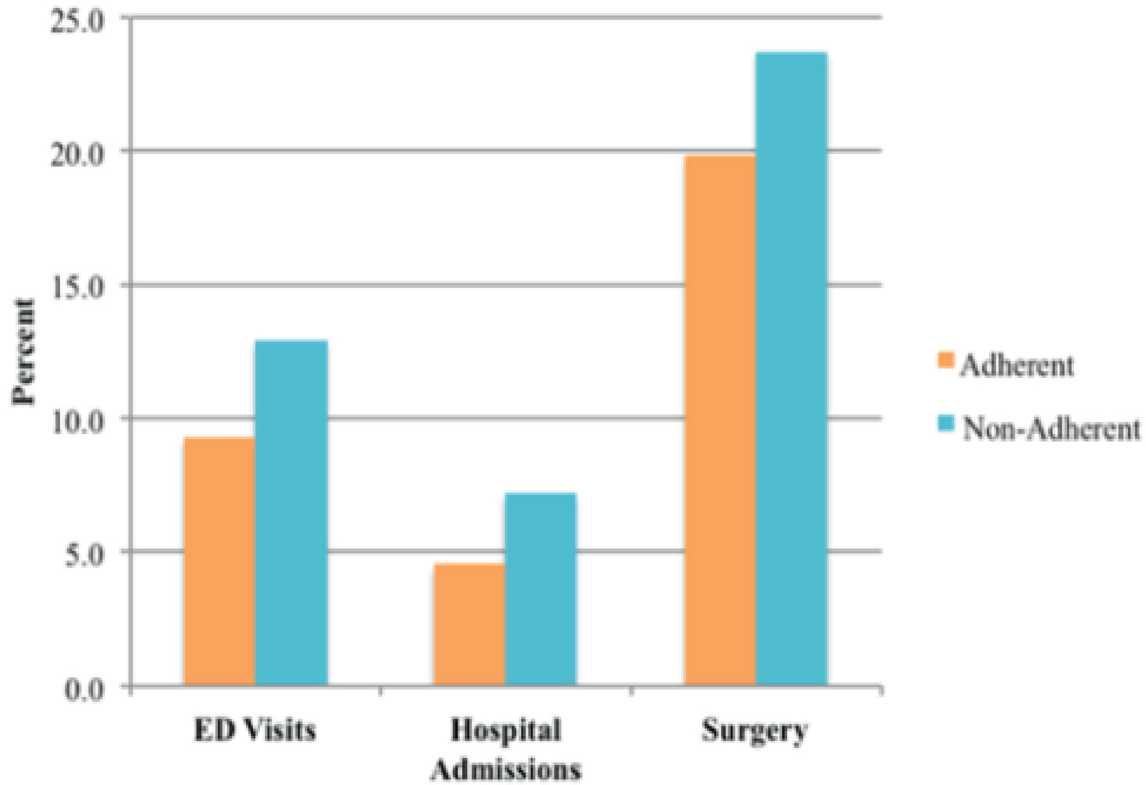

Figure 2. Proportion of adverse health outcomes after accounting for sociodemographic factors and level of comorbid disease.

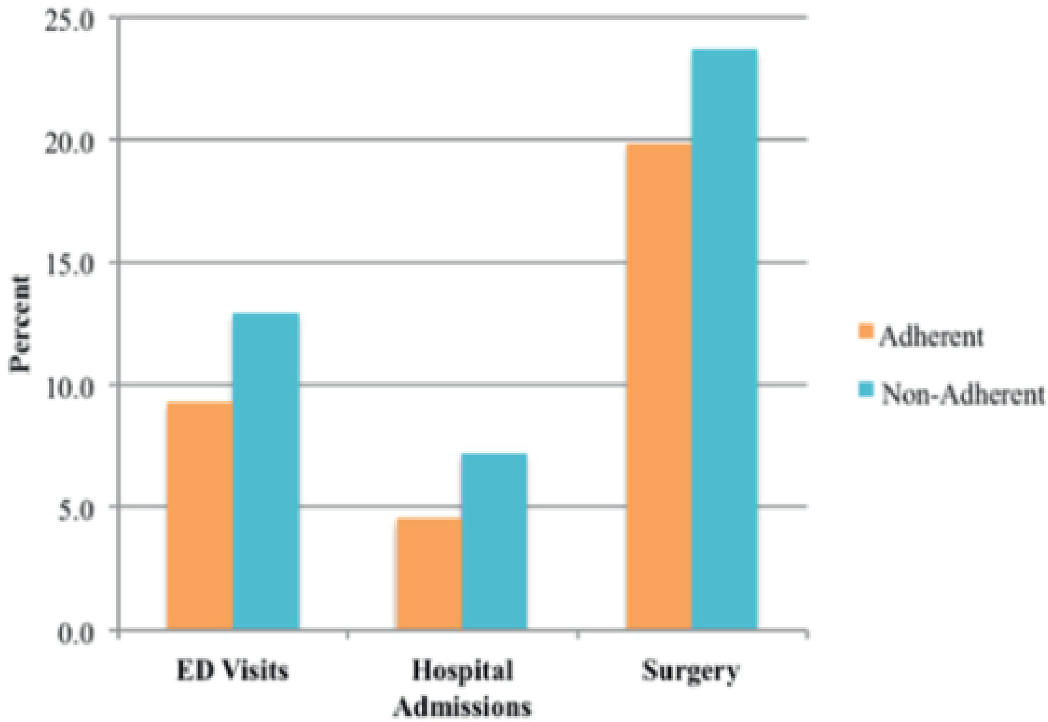

Figure 2. Proportion of adverse health outcomes after accounting for sociodemographic factors and level of comorbid disease.

Conclusions: Our data highlight the consequences of nonadherence to preventive pharmacological therapy among patients with kidney stones. To improve adherence further research is needed to understand patient and provider level factors that contribute to lower rates of adherence.

Preoperative Bladder Urine Culture as a Predictor of Intraoperative Stone Culture Results: Clinical Implications and Relationship to Stone Composition

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Purpose: We examine the relationship between urine and stone cultures in a large cohort of patients undergoing percutaneous stone removal and compare the findings in infectious vs metabolic calculi.

Materials and Methods: A total of 776 patients treated with percutaneous nephrolithotomy who had preoperative urine cultures and intraoperative stone cultures were included in the study. Statistical analysis used chi-square or logistic fit analysis as appropriate.

Results: Preoperative urine culture was positive in 352 patients (45.4%) and stone cultures were positive in 300 patients (38.7%). There were 75 patients (9.7%) with negative preoperative cultures who had positive stone cultures, and in patients with both cultures positive the organisms differed in 103 (13.3%). Gram-positive organisms predominated in preoperative urine and stone cultures.

Conclusions: Preoperative urine cultures in patients undergoing percutaneous nephrolithotomy are unreliable as there is a discordance with intraoperative stone cultures in almost a quarter of cases. There has been a notable shift toward gram-positive organisms in this cohort of patients.

Abbreviations and Acronyms

CT = computerized tomography

PCNL = percutaneous nephrolithotomy

SIRS = systemic inflammatory response syndrome

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The corresponding author certifies that, when applicable, a statement(s) has been included in the manuscript documenting institutional review board, ethics committee or ethical review board study approval; principles of Helsinki Declaration were followed in lieu of formal ethics committee approval; institutional animal care and use committee approval; all human subjects provided written informed consent with guarantees of

Table 2. *Preoperative bladder urine culture as a predictor of intraoperative stone culture results*

	Any Pos Stone Culture	Same Organism Found in Urine
Sensitivity for predicting stone culture results	0.75	0.62
Specificity for predicting stone culture results	0.73	0.60
Pos predictive value of urine culture	0.64	0.35

Table 4. *Urine and stone cultures with respect to stone composition*

	No. Struvite/Highly Carbonated Apatite Stone (%)	No. Metabolic Stone (%)
Both cultures neg	15 (12)	330 (51.2)
Pos urine culture only	23 (18.4)	104 (16.1)
Pos stone culture only	11 (8.8)	63 (9.8)
Both cultures pos	76 (60.8)	148 (22.9)
Totals	125	645

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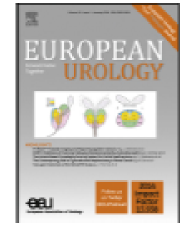

European Association of Urology

Platinum Priority – Stone Disease

Editorial by Matthew Bultitude and Kay Thomas on pp. 274–275 of this issue

Does Stepwise Voltage Ramping Protect the Kidney from Injury During Extracorporeal Shockwave Lithotripsy? Results of a Prospective Randomized Trial

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Article info

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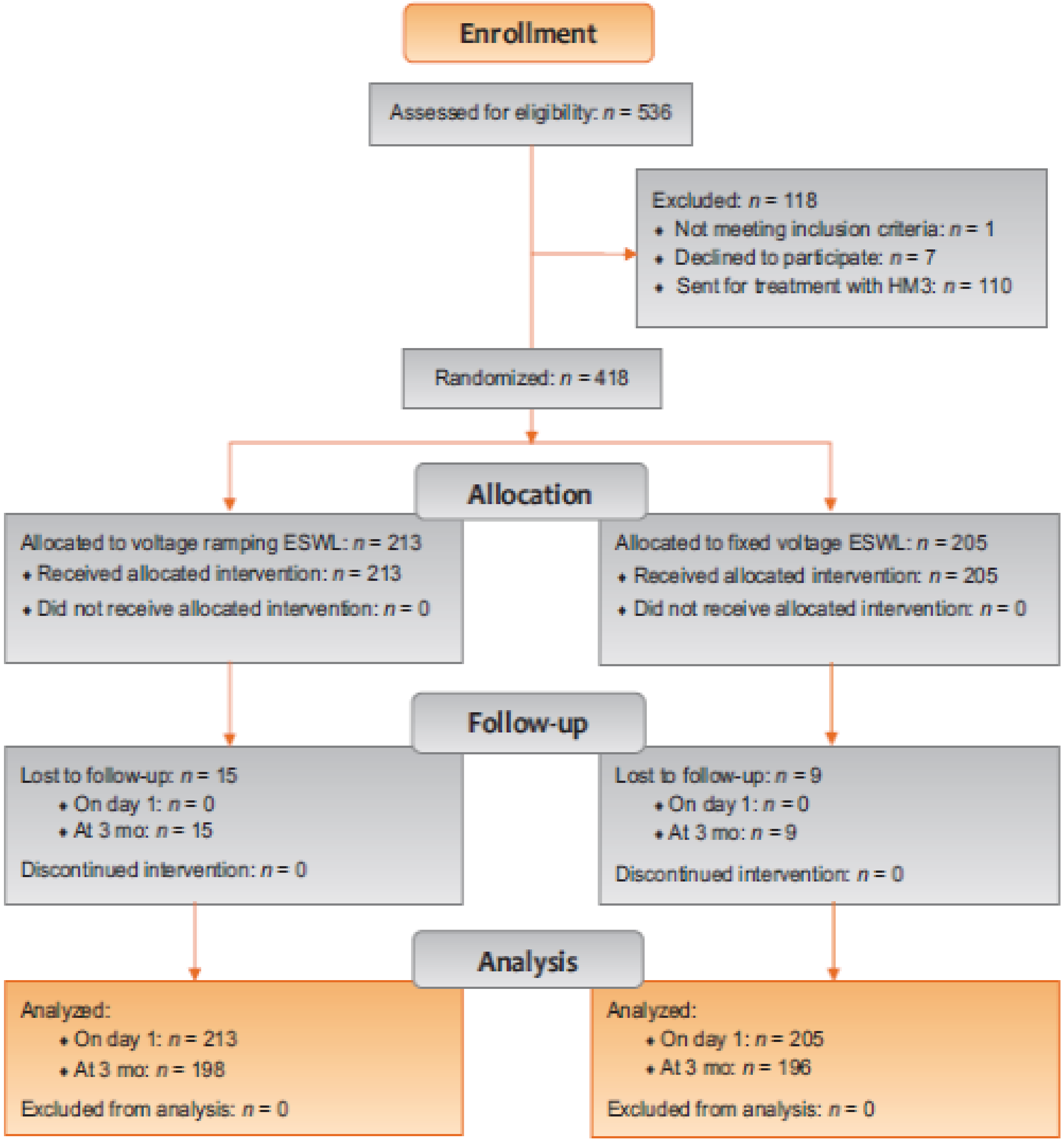
Voltage ramping

Abstract

Background: Renal damage is more frequent with new-generation lithotripters. However, animal studies suggest that voltage ramping minimizes the risk of complications following extracorporeal shock wave lithotripsy (SWL). In the clinical setting, the optimal voltage strategy remains unclear.
Objective: To evaluate whether stepwise voltage ramping can protect the kidney from damage during SWL.
Design, setting, and participants: A total of 418 patients with solitary or multiple unilateral kidney stones were randomized to receive SWL using a Modulith SLX-F2 lithotripter with either stepwise voltage ramping ($n = 213$) or a fixed maximal voltage ($n = 205$).
Intervention: SWL.
Outcomes measurements and statistical analysis: The primary outcome was sonographic evidence of renal hematomas. Secondary outcomes included levels of urinary markers of renal damage, stone disintegration, stone-free rate, and rates of secondary interventions within 3 mo of SWL. Descriptive statistics were used to compare clinical outcomes between the two groups. A logistic regression model was generated to assess predictors of hematomas.
Results and limitations: Significantly fewer hematomas occurred in the ramping group (12/213, 5.6%) than in the fixed group (27/205, 13%; $p = 0.008$). There was some evidence that the fixed group had higher urinary β_2-microglobulin levels after SWL compared to the ramping group ($p = 0.06$). Urinary microalbumin levels, stone disintegration, stone-free rate, and rates of secondary interventions did not significantly differ between the groups. The logistic regression model showed a significantly higher risk of renal hematomas in older patients (odds ratio [OR] 1.03, 95% confidence interval [CI] 1.00–1.05; $p = 0.04$). Stepwise voltage ramping was associated with a lower risk of hematomas (OR 0.39, 95% CI 0.19–0.80; $p = 0.01$). The study was limited by the use of ultrasound to detect hematomas.



Enrollment
Assessed for eligibility: n = 536
Excluded: n = 118
Not meeting inclusion criteria: n = 1
Declined to participate: n = 7
Sent for treatment with HM3: n = 110
Randomized: n = 418
Allocation
Allocated to voltage ramping ESWL: n = 213
Received allocated intervention: n = 213
Did not receive allocated intervention: n = 0
Allocated to fixed voltage ESWL: n = 205
Received allocated intervention: n = 205
Did not receive allocated intervention: n = 0
Follow-up
Lost to follow-up: n = 15
On day 1: n = 0
At 3 mo: n = 15
Discontinued intervention: n = 0
Lost to follow-up: n = 9
On day 1: n = 0
At 3 mo: n = 9
Discontinued intervention: n = 0
Analysis
Analyzed:
On day 1: n = 213
At 3 mo: n = 198
Excluded from analysis: n = 0
Analyzed:
On day 1: n = 205
At 3 mo: n = 196
Excluded from analysis: n = 0

Table 2 – Urinary levels of β_2-microglobulin and microalbumin before (day 0) and after (day 1) shockwave lithotripsy by mode of voltage application

	Ramping group	Fixed group	Difference, % (95% CI)	p value
β_2-Microglobulin				
Day 0	0.18 ± 0.38	0.15 ± 0.20		
Day 1	0.31 ± 0.64	0.90 ± 2.92	0.42 (−0.02 to 0.86)	0.06
Microalbumin				
Day 0	116.3 ± 178.6	131.3 ± 204.8		
Day 1	433.0 ± 435.2	442.7 ± 543.5	5.5 (−111.2 to 122.1)	0.9

CI = confidence interval.
Data are presented as mean ± standard deviation. All p values were calculated using analysis of covariance.

Table 3 – Clinical outcomes at 3 mo after extracorporeal shock wave lithotripsy (ESWL)

	Ramping group	Fixed group	Difference, % (95% CI)	p value
Stone disintegration (n = 394), n (%)				
Stone-free/no fragments	146 (74)	148 (76)	1.8 (−6.8 to 10)	0.7 *
Fragments <2 mm	34 (17)	25 (13)	−4.4 (−12 to 2.7)	0.2 *
Fragments 2–5 mm	13 (7)	19 (10)	3.1 (−2.4 to 8.8)	0.3 *
Fragments >5 mm	5 (3)	4 (2)	−0.5 (−0.4 to 0.3)	>0.9
Secondary intervention (n = 418), n (%)	23 (11)	20 (10)	−1 (−7.0 to 4.9)	0.7 *
Repeat ESWL	18 (8)	15 (7)	−1.1 (−6.5 to 4.2)	0.7 *
Percutaneous nephrolithotomy	4 (2)	3 (1)	−0.4 (−3.4 to 2.6)	>0.9
Ureterorenoscopy	1 (0.5)	2 (1)	0.5 (−1.8 to 3.1)	0.6
Complications other than hematoma (n = 418), n (%) [a]	10 (5)	7 (3)	−1.3 (−2.8 to 5.4)	0.5 *
Grade I	5 (2)	1 (0.5)	−1.9 (−4.9 to 0.7)	0.2
Grade II	–	1 (0.5)	–	–
Grade IIIa	4 (2)	5 (2)	0.6 (−2.6 to 3.9)	0.7
Grade IIIb	1 (0.5)	–	–	–
Grade IV/V	–	–	–	–

CI = confidence interval.
* χ^2 test; all other p values were calculated using Fischer's exact test.
[a] Dindo-Clavien classification.

Conclusions: In this prospective randomized study, stepwise voltage ramping during SWL was associated with a lower risk of renal damage compared to a fixed maximal voltage without compromising treatment effectiveness.

Ultrasonography Significantly Overestimates Stone Size When Compared to Low-dose, Noncontrast Computed Tomography

Kevan M. Sternberg, Brian Eisner, Troy Larson, Natalia Hernandez, Jullet Han, and Vernon M. Pais

OBJECTIVE To evaluate the differences between low-dose noncontrast computed tomography (NCCT) and renal ultrasound (US) in the identification and measurement of urinary calculi.

MATERIALS AND METHODS A retrospective review was conducted at 3 institutions of patients evaluated for flank pain with both renal US and NCCT, within 1 day of one another, from 2012 to 2015. Stone presence and size were compared between imaging modalities. Stone size was determined by largest measured diameter. Stones were grouped into size categories (≤5 mm, 5.1-10 mm, and >10 mm) based on NCCT and compared with US. Statistical analysis was performed using 2-sided *t* tests.

RESULTS One hundred fifty-five patients received both a renal US and NCCT within 1 day. In 79 patients (51.0%), both US and NCCT identified a stone for size comparison. Fifty-eight patients (37.4%) had a stone visualized on NCCT but not on US, and 2 patients (1.3%) had a stone documented on US but not seen on NCCT. The average NCCT size of the stones missed on US was 4.5 mm. When comparing the average largest stone diameter for US (9.1 mm) vs NCCT (6.9 mm), US overestimated stone size by 2.2 mm ($P < .001$). US overestimated stone size by 84.6% for stones ≤5 mm, 27.1% for stones 5.1-10 mm, and 3.0% for stones >10 mm.

Table 1. Categorical size analysis based on NCCT measurement of largest stone diameter

NCCT Measured Stone Diameter	Average Diameter on NCCT (mm)	Average Diameter on US (mm)	Frequency US Overestimate	Average US Size Overestimate (mm)
≤5 mm (n = 28)	3.9 (1.0)	7.2 (2.7)	82.1% (23/28)	3.3 (84.6%)
5.1-10 mm (n = 38)	7.0 (1.4)	8.9 (4.0)	52.6% (20/38)	1.9 (27.1%)
>10 mm (n=13)	13.2 (2.7)	13.6 (2.6)	38.5% (5/13)	0.4 (3.0%)

[illegible]

CONCLUSION US significantly overestimated stone size and this was most pronounced for small (≤5 mm) stones. The potential for systematic overestimation of stone size with standard US techniques should be taken into consideration when evaluating endourologic treatment options. UROLOGY 95: 67–71, 2016.

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Digital Tomosynthesis: A Viable Alternative to Noncontrast Computed Tomography for the Follow-Up of Nephrolithiasis?

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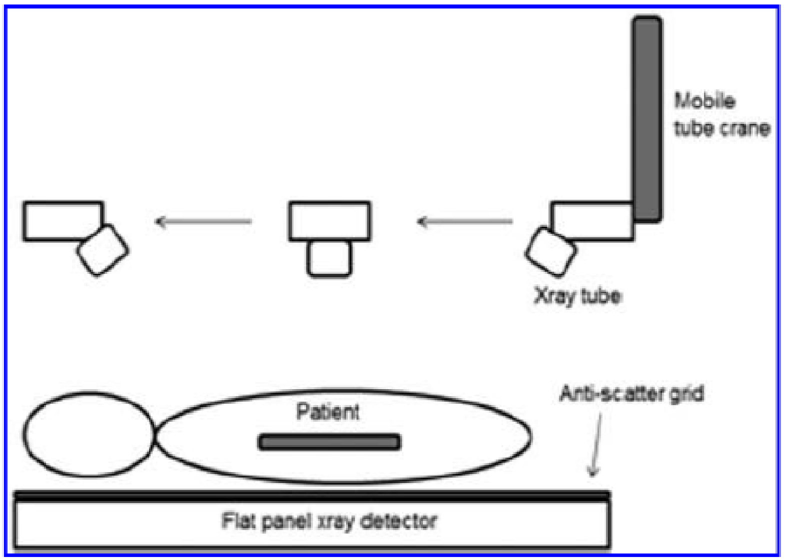
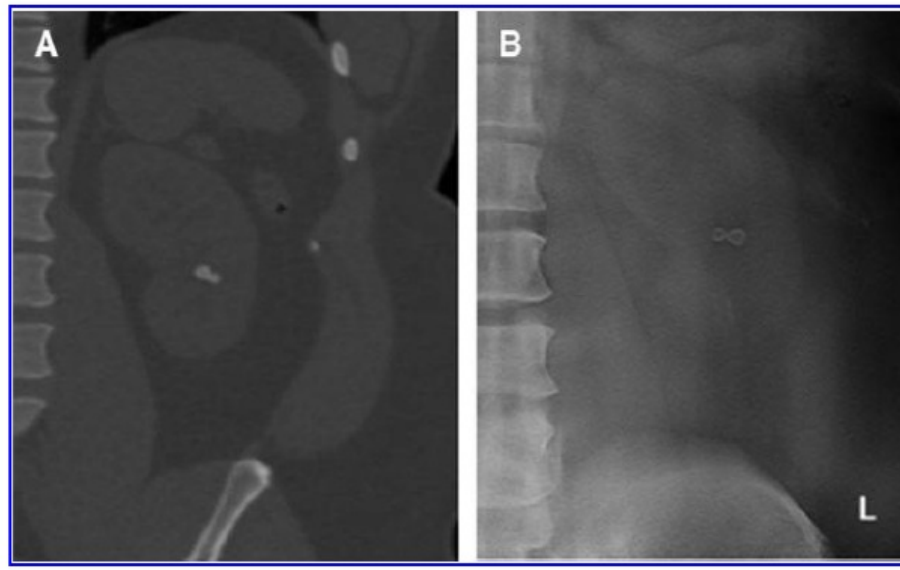
Abstract

Objective: Digital tomosynthesis (DT) is a new X-ray-based imaging technique that allows image enhancement with minimal increase in radiation exposure. The purpose of this study was to compare DT with noncontrast computed tomography (NCCT) and to evaluate its potential role for the follow-up of patients with nephrolithiasis in a nonemergent setting.

Methods: A retrospective review of patients with nephrolithiasis at our institution that underwent NCCT and DT from July 2012 to September 2013 was performed. Renal units (RUs) that did not undergo treatment or stone passage were randomly assigned to two blinded readers, who recorded stone count, size area (mm^2), maximum stone length (mm), and location, for both DT and NCCT. Mean differences per RU were compared. Potential variables affecting stone detection rate, including stone size and body mass index (BMI), were evaluated. Interobserver agreement was determined using the intraclass correlation coefficient to measure the consistency of measurements made by the readers.

Results: DT and NCCT demonstrated similar stone detection rates in terms of stone counts and stone area mm^2. Of the 79 RUs assessed, 41 RUs showed exact stone counts on DT and NCCT. The mean difference in stone area was 16.5 mm^2 (–4.6 to 38.5), $p = 0.121$. The mean size of the largest stone on NCCT and DT was 9.27 and 8.87 mm, respectively. Stone size and BMI did not cause a significant difference in stone detection rates. Interobserver agreement showed a strong correlation between readers and adequate reproducibility.


Mobile
tube crane
Xray tube
Patient
Anti-scatter grid
Flat panel xray detector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Conclusion: We found DT to be a comparable imaging modality to NCCT for the detection of intrarenal stones, without a significant effect from stone size and BMI and adequate reproducibility between multiple readers. DT appears to be an ideal alternative for following patients with nephrolithiasis due to its acceptable stone detection rates, low radiation exposure, and decreased cost compared to NCCT.

ΕΥΧΑΡΙΣΤΩ