

# Management of Urinary Stone Disease: Prevention, Treatment and Follow-Up





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## Introduction

Urinary stone disease is a common affliction of modern society. With westernization of global culture, the incidence of urinary stone disease is increasing worldwide. The prevalence varies on different societies due to the geographical, genetic and dietary factors [1]. In countries with a high standard of life such as Canada, USA or Nordic Societies, urinary stone prevalence is notably high as >10% [2]. Male/female predominancy have been decreasing over recent years [3]. In addition, children tend to form urinary stones from earlier ages [3]. All these determinations mentioned above reveal that stone formation is an important public health problem to be seriously concerned.

## Risk Groups for Urinary Stone Disease

The risk for stone formation is of particular interest because of its association with prevention and recurrence. In addition, it is imperative for pharmacological treatment [4]. Approximately 50% of stone formers experience recurrence of stones once in their remaining lifetime [4]. However, a group of patients are under high-risk of recurrence so they are possible candidates for preventive pharmacological therapies.

## High-Risk Stone Formers

- Early Onset of Stone Formation.
- Familial Stone Formation.
- Solitary Kidney.
- Hyperparathyroidism.
- Metabolic Syndrome.
- Gastrointestinal Malabsorptive Conditions.
- Neurogenic Bladder.
- Cystinuria.

- Renal Tubular Acidosis Type 1.
- Ureteropelvic Junction Obstruction.
- Vesicoureterorenal Reflux.
- Horseshoe Kidney.

## Classification of Stones

Urinary stones can be classified due to their composition, aetiology or characteristics on radiography. Stone composition is the basis for further management of patients. Urinary stones often compose of a mixture of different minerals. (Table 1) summarizes the most relevant components. Aetiology is another parameter for classification of urinary stones. It is also important to prevent recurrence in stone formers in their rest of life. (Table 2) lists groups of urinary stones according to their aetiology. Appearance of urinary stones on radiography is associated with their mineral composition. In addition, non-contrast-enhanced computed tomography can be used to determine the density of the stones which would affect treatment decisions (Table 3).

**Table 1:** Composition of Urinary Stones.

Composition of Urinary Stones	
Calcium oxalate monohydrate	Whewellite
Calcium oxalate dihydrate	Wheddelite
Calcium phosphate	Apatite
Calcium carbonate	Aragonite
Uric acid	Uricite
Magnesium ammonium phosphate	Struvite
Cystine	-
Xanthine	-
2,8-Dihydroxyadenine	-

**Table 2:** Classification of Stones According to Aetiology.

Infection Stones	Non-Infection Stones	Genetic Causes
Magnesium ammonium phosphate	Calcium oxalate	Cystine
Carbonate apatite	Calcium phosphate	Xanthine
Ammonium urate	Uric acid	2,8-Dihydroxyadenine

**Table 3:** X-ray Characteristics of Urinary Stones.

Radiopaque Stones	Radiolucent Stones
Calcium oxalate dihydrate	Uric acid
Calcium oxalate monohydrate	Xanthine
Calcium phosphate	2,8-Dihydroxyadenine

### Diagnostic Imaging

Ultrasound is the primary diagnostic tool with its multiple advantages such as low cost, reproducibility and having no risk of radiation which is very important for renal colic in pregnancy [5]. US has an acceptable sensitivity of 45% and specificity of >85% both for renal and ureteric stones [5]. Appearance of urinary tract dilatation also affects the sensitivity of US particularly for ureteric stones. Kidney-Ureter-Bladder (KUB) radiography is helpful in differentiating between radiopaque and radiolucent stones so that it is commonly used for follow-up rather decisive diagnosis. Although the advantages of US are mentioned above, some patients need emergent evaluation with computed tomography such as cases with solitary kidney or signs of pyelonephritis. Non-contrast-enhanced computed tomography has a sensitivity of 100% and specificity of >94.9% for urinary stones >3mm except indinavir stones [6]. In addition, CT gives detailed information about the abdominal pain in the absence of stones [7]. Risk of radiation can be reduced by low-dose CT without significant loss of diagnostic certainty. (96.6% sensitivity, 94.9% specificity)[8] Stones which have low density such as uric acid or xanthine stones can be easily detected on CT.

Moreover, dual-energy CT, a relatively new CT modality, can differentiate uric acid stones from calcium containing stones [9]. Imaging also gives valuable information to the physician about urinary anatomy which affects treatment decision. CT gives detailed information about kidney and surrounding structures, diversities such as duplicated collecting systems or ectopic kidneys so that CT is the standard imaging procedure before surgical intervention.

### Treatment Modalities for Urinary Stones

Asymptomatic renal stones could be observed with semi-annual follow-up. Treatment should be considered if stone growth or recurrent flank pain is detected.

### Spontaneous Passage of Pelvi-Ureteric Stones

Absolutely not all patients with pelvi-ureteric stones undergo surgical intervention. Proper hydration, non-steroidal antiinflammatory drugs,  $\alpha$ 1 adrenergic blockers help spontaneous passage of urinary stones and it is regarded as medical expulsive therapy (MET) [10]. Stones  $\leq$ 4 mm, ureteric stones under the location of iliac bifurcation are more likely to pass spontaneously to the bladder [11]. However, patients with severe renal colic

symptoms or pyelonephritis should not be observed with MET because of the risk of septicemia and septic shock.

### Oral Chemolysis

Oral chemolysis is a non-invasive treatment alternative only for uric acid stones. Patients with a prior stone analysis reporting uric acid stone or recurrent stone formers with low urinary pH, also stones with radiolucent X-ray characteristics and low density on CT would be good candidates for oral chemolysis. Oral chemolysis is based on alkalisation of urine by application of alkaline citrate or sodium bicarbonate. The higher the urinary pH, the more effective the chemolysis. However, it might promote calcium phosphate stone formation. Therefore, urinary pH should be adjusted to approximately 7.0.

### Extracorporeal Shock Wave Lithotripsy

Enhancements in endourology have caused to decrease interest in ESWL in recent years. Although endourologic interventions have higher stone free rates, ESWL has still advantages over them. Children are good candidates for ESWL, because of its high efficacy and low complication rates [12]. Adults who have multipl or severe co-morbidities constitute high risk groups for surgical intervention so that ESWL is a good alternative particularly for cases with renal, pelvic or proximal ureteric stones  $\leq$ 2 cm.

### Ureteroscopy and Retrograde Intrarenal Surgery

Rigid ureteroscopes are safe and effective for treatment of ureteric stones. Ureteroscopy have been the standard procedure for distal ureteric stones. However, proximal ureteric stones are more likely to be pushed back to the kidney during intervention so that flexibl ureteroscopes are preferred. RIRS by flexibl ureteroscopes is becoming more and more commonly performed in recent years. Shorter days of hospitalization, lower degrees of postoperative pain and lower rates of blood loss are main advantages of RIRS [13] over percutaneous nephrolithotomy. (PNL)

### Percutaneous Nephrolithotomy

Over years, PNL has been performed with standard 24-30 f nephroscopes. With popularization of minimization of surgical instruments, mini PNL have been widely accepted by several authors. First, these miniaturised instruments have been developed for pediatric cases but by the time they have become to replace standard intruments in all cases. According to the recent literature, mini PNL has comparable stone free rates with standard PNL but longer operation times. Perioperative blood loss and need for opioid analgesics are less likely in mini PNL. Another debate over PNL is whether supin or prone is the optimal position for the intervention. Recent literature has indicated similar efficacy and complication rates [14] but with an advantage of supin PNL as opportunity of concomitant RIRS [15].

### Conclusion

Urinary stone disease should be considered as a prominent problem concerning public health. Proper diet and hydration, modification of sedentary lifestyle are basic preventive measures to be concerned even from childhood. In addition, history of urinary

stone treatment should be regarded as an important risk factor for recurrence. Updates in recent treatment choices, both in medical therapies and surgical interventions, should be followed closely to perform the most proper treatment alternative for each case.

## References

- Trinchieri A CG (2003) Epidemiology, in Stone Disease. In: Segura JW, Khoury S, Pak CY, Preminger GM, Tolley D (Eds.). Health Publications: Paris.
- Brändle E, Wilbert D, Köhrmann KU, Alken P (2003) Study on the prevalence and incidence of urolithiasis in Germany comparing the years 1979 vs. 2000. *Eur Urol* 44: 709.
- Hesse AT (2009) Urinary Stones, Diagnosis, Treatment and Prevention of Recurrence. (3<sup>rd</sup> Edition). 2009, Basel, Switzerland.
- Strohmaier WL (2000) Course of calcium stone disease without treatment. What can we expect? *Eur Urol* 37: 339.
- Ghiculete D, Pace KT, Honey RJ (2010) Limitations to ultrasound in the detection and measurement of urinary tract calculi. *Urology* 76: 295.
- Smith Bindman R, Chandra Aubin, John Bailitz, Rimon N Bengiamin, Carlos A Camargo, et al. (2014) Ultrasonography versus computed tomography for suspected nephrolithiasis. *N Engl J Med* 371: 1100.
- Heidenreich A, Desgrandschamps F, Terrier F (2002) Modern approach of diagnosis and management of acute flank pain: review of all imaging modalities. *Eur Urol* 41: 351.
- Niemann T, Kollman T, Bongartz G (2008) Diagnostic performance of low-dose CT for the detection of urolithiasis: a metaanalysis. *AJR Am J Roentgenol* 191: 396.
- Zheng X, Liu Y, Li M, Wang Q, Song B (2016) Dual-energy computed tomography for characterizing urinary calcified calculi and uric acid calculi: A meta-analysis. *Eur J Radiol* 85: 1843.
- Pickard R, K Starr, G MacLennan, Thomas Lam, Ruth Thomas, et al. (2015) Medical expulsive therapy in adults with ureteric colic: a multicentre, randomised, placebo-controlled trial. *Lancet* 386: 341.
- Furyk JS, Chu K, Banks C, Greenslade J, Keijzers G, et al. (2016) Distal Ureteric Stones and Tamsulosin: A Double-Blind, Placebo-Controlled, Randomized, Multicenter Trial. *Ann Emerg Med* 67: 86.
- Rassweiler JJ, Renner C, Chaussy C, Thuroff S (2001) Treatment of renal stones by extracorporeal shockwave lithotripsy: an update. *Eur Urol* 39: 187.
- Turna B, Stein RJ, Smaldone MC, Santos BR, Kefer JC, et al. (2008) Safety and efficacy of flexible ureterorenoscopy and holmium: YAG lithotripsy for intrarenal stones in anticoagulated cases. *J Urol* 179: 1415.
- Yuan D, Liu Y, Rao H, Cheng T, Sun Z, et al. (2016) Supine Versus Prone Position in Percutaneous Nephrolithotomy for Kidney Calculi: A Meta-Analysis. *J Endourol* 30: 754.
- Cracco CM, Scoffone CM (2011) ECIRS (Endoscopic Combined Intrarenal Surgery) in the Galdakao-modified supine Valdivia position: a new life for percutaneous surgery? *World J Urol* 29: 821.

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