

UROLITHIASIS (RENAL CALCULI)

Kidney stones (calculi) are formed of mineral deposits, most commonly calcium oxalate and calcium phosphate; however, uric acid, struvite, and cystine are also calculus formers. Although renal calculi can form anywhere in the urinary tract, they are most commonly found in the renal pelvis and calyces. Renal calculi can remain asymptomatic until passed into a ureter and/or urine flow is obstructed, when the potential for renal damage is acute.

CARE SETTING

Acute episodes may require inpatient treatment on a medical or surgical unit.

RELATED CONCERNS

Fluid and electrolyte imbalances
Metabolic acidosis (primary base bicarbonate deficiency)
Metabolic alkalosis (primary base bicarbonate excess)
Psychosocial aspects of care
Renal failure: acute

Patient Assessment Database

Dependent on size, location, and etiology of calculi.

ACTIVITY/REST

May report: Sedentary occupation or occupation in which patient is exposed to high environmental temperatures
Activity restrictions/immobility due to a preexisting condition (e.g., debilitating disease, spinal cord injury)

CIRCULATION

May exhibit: Elevated BP/pulse (pain, anxiety, kidney failure)
Warm, flushed skin; pallor

ELIMINATION

May report: History of recent/chronic UTI; previous obstruction (calculi)
Decreased urinary output, bladder fullness
Burning, urgency with urination
Diarrhea

May exhibit: Oliguria, hematuria, pyuria
Alterations in voiding pattern

FOOD/FLUID

May report: Nausea/vomiting, abdominal tenderness
Diet high in purines, calcium oxalate, and/or phosphates
Insufficient fluid intake; does not drink fluids well

May exhibit: Abdominal distension; decreased/absent bowel sounds
Vomiting

PAIN/DISCOMFORT

May report: Acute episode of excruciating, colicky pain with location depending on stone location, e.g., in the flank in the region of the costovertebral angle; may radiate to back, abdomen, and down to the groin/genitalia. Constant dull pain suggests calculi located in the renal pelvis or calyces.
Pain may be described as acute, severe, not relieved by positioning or any other measures

May exhibit: Guarding; distraction behaviors; self-focusing
Tenderness in renal areas on palpation

SAFETY

May report: Use of alcohol
Fever; chills

TEACHING/LEARNING

May report: Family history of calculi, kidney disease, hypertension, gout, chronic UTI
History of small-bowel disease, previous abdominal surgery, hyperparathyroidism
Use of antibiotics, antihypertensives, sodium bicarbonate, allopurinol, phosphates, thiazides, excessive intake of calcium or vitamin D

Discharge plan considerations: **DRG projected mean length of inpatient stay: 2.9 days**

Refer to section at end of plan for postdischarge considerations.

DIAGNOSTIC STUDIES

Urinalysis: Color may be yellow, dark brown, bloody. Commonly shows RBCs, WBCs, crystals (cystine, uric acid, calcium oxalate), casts, minerals, bacteria, pus; pH may be less than 5 (promotes cystine and uric acid stones) or higher than 7.5 (promotes magnesium, struvite, phosphate, or calcium phosphate stones).

Urine (24-hr): Cr, uric acid, calcium, phosphorus, oxalate, or cystine may be elevated.

Urine culture: May reveal UTI (*Staphylococcus aureus*, *Proteus*, *Klebsiella*, *Pseudomonas*).

Biochemical survey: Elevated levels of magnesium, calcium, uric acid, phosphates, protein, electrolytes.

Serum and urine BUN/Cr: Abnormal (high in serum/low in urine) secondary to high obstructive stone in kidney causing ischemia/necrosis.

Serum chloride and bicarbonate levels: Elevation of chloride and decreased levels of bicarbonate suggest developing renal tubular acidosis.

CBC:

Hb/Hct: Abnormal if patient is severely dehydrated or polycythemia is present (encourages precipitation of solids), or patient is anemic (hemorrhage, kidney dysfunction/failure).

RBCs: Usually normal.

WBCs: May be increased, indicating infection/septicemia.

Parathyroid hormone (PTH): May be increased if kidney failure present. (PTH stimulates reabsorption of calcium from bones, increasing circulating serum and urine calcium levels.)

KUB x-ray: Shows presence of calculi and/or anatomical changes in the area of the kidneys or along the course of the ureter.

IVP: Provides rapid confirmation of urolithiasis as a cause of abdominal or flank pain. Shows abnormalities in anatomical structures (distended ureter) and outline of calculi.

Cystoureteroscopy: Direct visualization of bladder and ureter may reveal stone and/or obstructive effects.

CT scan: Identifies/delineates calculi and other masses; kidney, ureteral, and bladder distension.

Ultrasound of kidney: To determine obstructive changes, location of stone; without the risk of failure induced by contrast medium.

NURSING PRIORITIES

1. Alleviate pain.
2. Maintain adequate renal functioning.
3. Prevent complications.
4. Provide information about disease process/prognosis and treatment needs.

DISCHARGE GOALS

1. Pain relieved/controlled.
2. Fluid/electrolyte balance maintained.
3. Complications prevented/minimized.
4. Disease process/prognosis and therapeutic regimen understood.
5. Plan in place to meet needs after discharge.

NURSING DIAGNOSIS: Pain, acute

May be related to

Increased frequency/force of ureteral contractions
Tissue trauma, edema formation; cellular ischemia

Possibly evidenced by

Reports of colicky pain
Guarding/distraction behaviors, restlessness, moaning, self-focusing, facial mask of pain, muscle tension
Autonomic responses

DESIRED OUTCOMES/EVALUATION CRITERIA—PATIENT WILL:

Pain Level (NOC)

Report pain is relieved with spasms controlled.
Appear relaxed, able to sleep/rest appropriately.

ACTIONS/INTERVENTIONS	RATIONALE
<p>Pain Management (NIC)</p> <p>Independent</p> <p>Document location, duration, intensity (0–10 scale), and radiation. Note nonverbal signs, e.g., elevated BP and pulse, restlessness, moaning, thrashing about.</p> <p>Explain cause of pain and importance of notifying caregivers of changes in pain occurrence/characteristics.</p> <p>Provide comfort measures, e.g., back rub, restful environment.</p> <p>Assist with/encourage use of focused breathing, guided imagery, diversional activities.</p> <p>Encourage/assist with frequent ambulation as indicated and increased fluid intake of at least 3–4 L/day within cardiac tolerance.</p> <p>Note reports of increased/persistent abdominal pain.</p>	<p>Helps evaluate site of obstruction and progress of calculi movement. Flank pain suggests that stones are in the kidney area, upper ureter. Flank pain radiates to back, abdomen, groin, genitalia because of proximity of nerve plexus and blood vessels supplying other areas. Sudden, severe pain may precipitate apprehension, restlessness, severe anxiety.</p> <p>Provides opportunity for timely administration of analgesia (helpful in enhancing patient’s coping ability and may reduce anxiety) and alerts caregivers to possibility of passing of stone/developing complications. Sudden cessation of pain usually indicates stone passage.</p> <p>Promotes relaxation, reduces muscle tension, and enhances coping.</p> <p>Redirects attention and aids in muscle relaxation.</p> <p>Renal colic can be worse in the supine position. Vigorous hydration promotes passing of stone, prevents urinary stasis, and aids in prevention of further stone formation.</p> <p>Complete obstruction of ureter can cause perforation and extravasation of urine into perirenal space. This represents an acute surgical emergency.</p>

ACTIONS/INTERVENTIONS	RATIONALE
<p>Pain Management (NIC)</p> <p>Independent</p> <p>Administer medications as indicated:</p> <ul style="list-style-type: none"> Narcotics, e.g., meperidine (Demerol), morphine; Antispasmodics, e.g., flavoxate (Urispas), oxybutynin (Ditropan); Corticosteroids. <p>Collaborative</p> <p>Apply warm compresses to back.</p> <p>Maintain patency of catheters when used.</p>	<p>Usually given during acute episode to decrease ureteral colic and promote muscle/mental relaxation.</p> <p>Decreasing reflex spasm may decrease colic and pain.</p> <p>May be used to reduce tissue edema to facilitate movement of stone.</p> <p>Relieves muscle tension and may reduce reflex spasms.</p> <p>Prevents urinary stasis/retention, reduces risk of increased renal pressure and infection.</p>

<p>NURSING DIAGNOSIS: Urinary Elimination, impaired</p> <p>May be related to</p> <p>Stimulation of the bladder by calculi, renal or ureteral irritation</p> <p>Mechanical obstruction, inflammation</p> <p>Possibly evidenced by</p> <p>Urgency and frequency; oliguria (retention)</p> <p>Hematuria</p> <p>DESIRED OUTCOMES/EVALUATION CRITERIA—PATIENT WILL:</p> <p>Urinary Elimination (NOC)</p> <p>Void in normal amounts and usual pattern.</p> <p>Experience no signs of obstruction.</p>

ACTIONS/INTERVENTIONS	RATIONALE
<p>Urinary Elimination Enhancement (NIC)</p> <p>Independent</p> <p>Monitor I&O and characteristics of urine.</p>	<p>Provides information about kidney function and presence of complications, e.g., infection and hemorrhage. Bleeding may indicate increased obstruction or irritation of ureter. <i>Note:</i> Hemorrhage due to ureteral ulceration is rare.</p>

ACTIONS/INTERVENTIONS	RATIONALE
<p>Urinary Elimination Enhancement (NIC)</p> <p>Independent</p> <p>Determine patient's normal voiding pattern and note variations.</p> <p>Encourage increased fluid intake.</p> <p>Strain all urine. Document any stones expelled and send to laboratory for analysis.</p> <p>Investigate reports of bladder fullness; palpate for suprapubic distension. Note decreased urine output, presence of periorbital/dependent edema.</p> <p>Observe for changes in mental status, behavior, or level of consciousness.</p> <p>Collaborative</p> <p>Monitor laboratory studies, e.g., electrolytes, BUN, Cr.</p> <p>Obtain urine for culture and sensitivities.</p> <p>Administer medications as indicated, e.g.:</p> <ul style="list-style-type: none"> Acetazolamide (Diamox), allopurinol (Zyloprim); Hydrochlorothiazide (Esidrix, HydroDIURIL), chlorthalidone (Hygroton); Ammonium chloride; potassium or sodium phosphate; Antibiotics; Sodium bicarbonate; Ascorbic acid. 	<p>RATIONALE</p> <p>Calculi may cause nerve excitability, which causes sensations of urgent need to void. Usually frequency and urgency increase as calculus nears ureterovesical junction.</p> <p>Increased hydration flushes bacteria, blood, and debris and may facilitate stone passage.</p> <p>Retrieval of calculi allows identification of type of stone and influences choice of therapy.</p> <p>Urinary retention may develop, causing tissue distension (bladder/kidney), and potentiates risk of infection, renal failure.</p> <p>Accumulation of uremic wastes and electrolyte imbalances can be toxic to the CNS.</p> <p>Elevated BUN, Cr, and certain electrolytes indicate presence/degree of kidney dysfunction.</p> <p>Determines presence of UTI, which may be causing/complicating symptoms.</p> <p>Increases urine pH (alkalinity) to reduce formation of acid stones. Antigout agents such as allopurinol (Zyloprim) also lower uric acid production and potential of stone formation.</p> <p>May be used to prevent urinary stasis and decrease calcium stone formation if not caused by underlying disease process such as primary hyperthyroidism or vitamin D abnormalities.</p> <p>Reduces phosphate stone formation.</p> <p>Presence of UTI/alkaline urine potentiates stone formation.</p> <p>Replaces losses incurred during bicarbonate wasting and/or alkalinization of urine; may reduce/prevent formation of some calculi.</p> <p>Acidifies urine to prevent recurrence of alkaline stone formation.</p>

ACTIONS/INTERVENTIONS	RATIONALE
<p>Urinary Elimination Enhancement (NIC)</p> <p>Independent</p> <p>Maintain patency of indwelling catheters (ureteral, urethral, or nephrostomy) when used.</p> <p>Irrigate with acid or alkaline solutions as indicated.</p> <p>Prepare patient for/assist with endoscopic procedures, e.g.:</p> <ul style="list-style-type: none"> Basket procedure; Ureteral stents; Percutaneous or open pyelolithotomy, nephrolithotomy, ureterolithotomy; Percutaneous ultrasonic lithotripsy; Extracorporeal shockwave lithotripsy (ESWL). 	<p>May be required to facilitate urine flow/prevent retention and corresponding complications. <i>Note:</i> Tubes may be occluded by stone fragments.</p> <p>Changing urine pH may help dissolve stones and prevent further stone formation.</p> <p>Calculi in the distal and midureter may be removed by endoscopic cystoscope with capture of the stone in a basketing catheter.</p> <p>Catheters are positioned above the stone to promote urethral dilation/stone passage. Continuous or intermittent irrigation can be carried out to flush kidneys/ureters and adjust pH of urine to permit dissolution of stone fragments following lithotripsy.</p> <p>Surgery may be necessary to remove stone that is too large to pass through ureters.</p> <p>Invasive shock wave treatment for stones in renal pelvis/calyx or upper ureters.</p> <p>Noninvasive procedure in which kidney stones are pulverized by shock waves delivered from outside the body.</p>

<p>NURSING DIAGNOSIS: Fluid Volume, risk for deficient</p> <p>Risk factors may include</p> <p>Nausea/vomiting (generalized abdominal and pelvic nerve irritation from renal or ureteral colic)</p> <p>Postobstructive diuresis</p> <p>Possibly evidenced by</p> <p>[Not applicable; presence of signs or symptoms establishes an <i>actual</i> diagnosis.]</p> <p>DESIRED OUTCOMES/EVALUATION CRITERIA—PATIENT WILL:</p> <p>Hydration (NOC)</p> <p>Maintain adequate fluid balance as evidenced by vital signs and weight within patient's normal range, palpable peripheral pulses, moist mucous membranes, good skin turgor.</p>

ACTIONS/INTERVENTIONS	RATIONALE
<p>Fluid/Electrolyte Management (NIC)</p> <p>Independent</p> <p>Monitor I&O.</p> <p>Document incidence and note characteristics and frequency of vomiting and diarrhea, as well as accompanying or precipitating events.</p> <p>Increase fluid intake to 3–4 L/day within cardiac tolerance.</p> <p>Monitor vital signs. Evaluate pulses, capillary refill, skin turgor, and mucous membranes.</p> <p>Weigh daily.</p>	<p>Comparing actual and anticipated output may aid in evaluating presence/degree of renal stasis/impairment. <i>Note:</i> Impaired kidney functioning and decreased urinary output can result in higher circulating volumes with signs/symptoms of HF.</p> <p>Nausea/vomiting and diarrhea are commonly associated with renal colic because celiac ganglion serves both kidneys and stomach. Documentation may help rule out other abdominal occurrences as a cause for pain or pinpoint calculi.</p> <p>Maintains fluid balance for homeostasis and “washing” action that may flush the stone(s) out. Dehydration and electrolyte imbalance may occur secondary to excessive fluid loss (vomiting and diarrhea).</p> <p>Indicators of hydration/circulating volume and need for intervention. <i>Note:</i> Decreased GFR stimulates production of renin, which acts to raise BP in an effort to increase renal blood flow.</p> <p>Rapid weight gain may be related to water retention.</p>
<p>Collaborative</p> <p>Monitor Hb/Hct, electrolytes.</p> <p>Administer IV fluids.</p> <p>Provide appropriate diet, clear liquids, bland foods as tolerated.</p> <p>Administer medications as indicated: antiemetics, e.g., prochlorperazine (Compazine).</p>	<p>Assesses hydration and effectiveness of/need for interventions.</p> <p>Maintains circulating volume (if oral intake is insufficient), promoting renal function.</p> <p>Easily digested foods decrease GI activity/irritation and help maintain fluid and nutritional balance.</p> <p>Reduces nausea/vomiting.</p>

NURSING DIAGNOSIS: Knowledge, deficient [Learning Need] regarding condition, prognosis, treatment, self-care, and discharge needs

May be related to

Lack of exposure/recall; information misinterpretation
Unfamiliarity with information resources

Possibly evidenced by

Questions; request for information; statement of misconception
Inaccurate follow-through of instructions, development of preventable complications

DESIRED OUTCOMES/EVALUATION CRITERIA—PATIENT WILL:

Knowledge: Illness Care (NOC)

Verbalize understanding of disease process and potential complications.
Correlate symptoms with causative factors.
Verbalize understanding of therapeutic needs.
Initiate necessary lifestyle changes and participate in treatment regimen.

ACTIONS/INTERVENTIONS	RATIONALE
<p>Teaching: Disease Process (NIC)</p> <p>Independent</p> <p>Review disease process and future expectations.</p> <p>Stress importance of increased fluid intake, e.g., 3–4L/day or as much as 6–8 L/day. Encourage patient to notice dry mouth and excessive diuresis/diaphoresis and to increase fluid intake whether or not feeling thirsty.</p> <p>Review dietary regimen, as individually appropriate:</p> <p>Low-purine diet, e.g., limited lean meat, turkey, legumes, whole grains, alcohol;</p> <p>Low-calcium diet, e.g., limited milk, cheese, green leafy vegetables, yogurt;</p> <p>Low-oxalate diet, e.g., restrict chocolate, caffeine-containing beverages, beets, spinach.</p>	<p>Provides knowledge base from which patient can make informed choices.</p> <p>Flushes renal system, decreasing opportunity for urinary stasis and stone formation. Increased fluid losses/dehydration require additional intake beyond usual daily needs.</p> <p>Diet depends on the type of stone. Understanding reason for restrictions provides opportunity for patient to make informed choices, increases cooperation with regimen, and may prevent recurrence.</p> <p>Decreases oral intake of uric acid precursors.</p> <p>Reduces risk of calcium stone formation. <i>Note:</i> Research suggests that restricting dietary calcium is not helpful in reducing calcium-stone formation, and researchers, although not advocating high-calcium diets, are urging that calcium limitation be reexamined.</p> <p>Reduces calcium oxalate stone formation.</p>

ACTIONS/INTERVENTIONS	RATIONALE
<p>Teaching: Disease Process (NIC)</p> <p>Independent</p> <p>Shorr regimen: low-calcium/phosphorus diet with aluminum carbonate gel 30–40 mL, 30 min pc/hs.</p> <p>Discuss medication regimen; avoidance of OTC drugs, and reading all product/food ingredient labels.</p> <p>Encourage regular activity/exercise program.</p> <p>Active-listen concerns about therapeutic regimen/lifestyle changes.</p> <p>Identify signs/symptoms requiring medical evaluation, e.g., recurrent pain, hematuria, oliguria.</p> <p>Demonstrate proper care of incisions/catheters if present.</p>	<p>Prevents phosphatic calculi by forming an insoluble precipitate in the GI tract, reducing the load to the kidney nephron. Also effective against other forms of calcium calculi. <i>Note:</i> May cause constipation.</p> <p>Drugs will be given to acidify or alkalize urine, depending on underlying cause of stone formation. Ingestion of products containing individually contraindicated ingredients (e.g., calcium, phosphorus) potentiates recurrence of stones.</p> <p>Inactivity contributes to stone formation through calcium shifts and urinary stasis.</p> <p>Helps patient work through feelings and gain a sense of control over what is happening.</p> <p>With increased probability of recurrence of stones, prompt interventions may prevent serious complications.</p> <p>Promotes competent self-care and independence.</p>

POTENTIAL CONSIDERATIONS following acute hospitalizations (dependent on patient's age, physical condition/presence of complications, personal resources, and life responsibilities)

Urinary Elimination, impaired—recurrence of calculi.