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Erin Layton
layton1@otterbein.edu

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Nephrolithiasis
Erin L Layton, BSN, RN, CCRN
Otterbein University, Westerville, Ohio

Introduction
Nephrolithiasis, also known as kidney stones, calculi or uric calculi, are a common condition associated with crystalline and organic elements that are found in the urinary tract. Stones form as a result of urine that has become supersaturated with a mineral, drug, or the metabolism of a drug (Khan et al., 2017).

This subject was chosen because nephrolithiasis poses a significant health and financial burden in the United States and worldwide. In the year 2000, the cost of hospital inpatient, outpatient, and emergency services totaled an estimated $21 billion in the United States (Ziemba & Matlaga, 2017). With the increasing incidence and prevalence of pediatric and adult nephrolithiasis, health care costs and morbidity are expected to rise (Bataia & Taisan, 2016). Obstruction of an infected kidney, or urolithiasis, or urinary tract stones with infections require immediate intervention to prevent sepsis, which can be fatal. Nephrolithiasis was once thought to be an insidious and mostly asymptomatic disorder, but is now considered to be a systemic disease and marker for other diseases (Cunningham, Noble, Al-Moheber, & Walsh, 2016).

One of the kidneys’ functions is the removal of waste and excessive substances from the blood. Nephrolithiasis, or kidney stones, form when:

- Crystalization occurs when the concentration of two ions exceeds their saturation point in the solution” (Cunningham et al., 2016, p. 1114).
- Stones are generally made of soluable chemicals. In the urinary tract, crystals in urine can become supersaturated with a mineral, drug, or metabolite.
- When urine becomes supersaturated the chemical is unable to stay dissolved.
- Solutes precipitate from crystals (AUA, 2019).
- Crystals then grow, aggregate, and adhere to the kidney, bladder, urethra, ureter, and possibly the vascular system (AUA, 2019).

A diagnosis of nephrolithiasis was made based on:

- History and physical, including dietary history
- Ultrasound, non-contrast computed tomography (CT) scan of the abdomen and pelvis
- Midstream clean catch urine sample for urinalysis, microscopy, and culture
- Serum chemistry and complete blood count (CBC)
- Exclusion of differential diagnoses, such as acute abdomen, abdominal trauma, liver disease, pheochromocytoma, and vascular pseudocysts (AUA, 2019).

The AUA utilized the Management of acute renal colic pathway from the AUA (2019). It is important for healthcare providers to know which individuals require urgent or non-urgent intervention versus observation. A CT scan confirmed the presence of a stone ≥5mm in diameter and the individual did not have any indications for urgent intervention. A consult was placed to a urologist and the patient was scheduled for elective intervention. Pain was managed with non-steroidal anti-inflammatory drugs and hydration was provided (AUA, 2019).

Signs and Symptoms
Sens and symptoms of nephrolithiasis can vary in adults and children, and include:

- Adults:
  - Renal-ureteral colic (acute, intermittent pain) caused by short or long distention of the ureter
  - Nausea and/or vomiting, due to nephrolithiasis and obstruction of renal capsule (Cunningham et al., 2014)
  - Low pain
  - Dysuria
  - Urinary frequency
  - Micro- or macrohematuria or brown urine
  - Fever and/or chills
  - Urinary tract infection (Akan et al., 2017)

- Children may also have vague symptoms, such as:
  - Inability
  - Unmotivated crying
  - Motor agitation (Akan et al., 2017)

Significance of Pathophysiology
Once thought to be the result of diet and abnormal metabolism of electrolytes by the kidneys, nephrolithiasis is now known to be a systemic disease and indicator for other systemic diseases (Ziemba & Matlaga, 2017, p. 303). Obesity, diabetes, hyperuricemia and metabolic syndrome are considered risk factors for stone formation. Stones can lead to hypoxia, chronic kidney disease, and end-stage renal disease (Shah & Calle, 2016).

Conditions and diseases associated with nephrolithiasis:
- Metabolic Syndrome, increase in risk with more traits
- Diabetes Mellitus, association increased with history of insulin use and severity of high and fasting glucose and HbA1c
- Cardiovascular disease
- Chronic kidney disease and end-stage renal disease

Obstructions can cause direct injury to the kidney: In the ureter, the pressure in the renal pelvis is increased with increased glomerular filtration rate (GFR) at 24 hours before stone development, and after 24 hours ischemia can occur (AUA, 2019).

Implications for Nursing Care
APRNs play a crucial role in diagnosis, treatment, and prevention of nephrolithiasis, management, and prevention of future stone formation (Ziemba & Matlaga, 2017).

Conclusions
Nephrolithiasis, which was once considered to be an isolated condition, is now known to be a systemic disease and significant cause of morbidity, mortality, and healthcare expenditure. With increasing prevalence, incidence, and stone recurrence rates worldwide, it is imperative that healthcare providers receive proper education on the pathophysiology, diagnosis, management, and prevention of nephrolithiasis (Ziemba & Matlaga, 2017).

Key Points:
- Stones form as a result of supersaturated urine
- Many factors can contribute to nephrolithiasis
- Stone recurrence is preventable with proper diagnosis and diet modifications specific to the stone type
- Nephrolithiasis is associated with and is known to cause other serious systemic diseases