

Kidney stones afflict more than 500,000 Americans each year. Approximately 10 percent of the U.S. population will get kidney stones in their lifetime. The pain from these stones can be excruciating and incapacitating. Nearly 60 percent of people with kidney stones will have a recurrence within 10 years of the first stone.

The presence of a kidney stone is generally disqualifying for FAA aeromedical certification. Once the pilot is stone-free, he or she may resume flying duties after receiving clear-

Kidney Stones, Pilots, and The FAA

Kidney stones can be agonizing and grounding—to prevent them, drink plenty of water; to deal with them, and related medical certification issues, get help from ALPA's Aeromedical Office

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ance from the aeromedical examiner (AME) or the FAA.

Under certain circumstances, the FAA may clear pilots with retained kidney stones to return to safety-sensitive duties. In 2009, ALPA's Aeromedical Office helped more than 200 pilots with kidney stones return to flying-related duties.

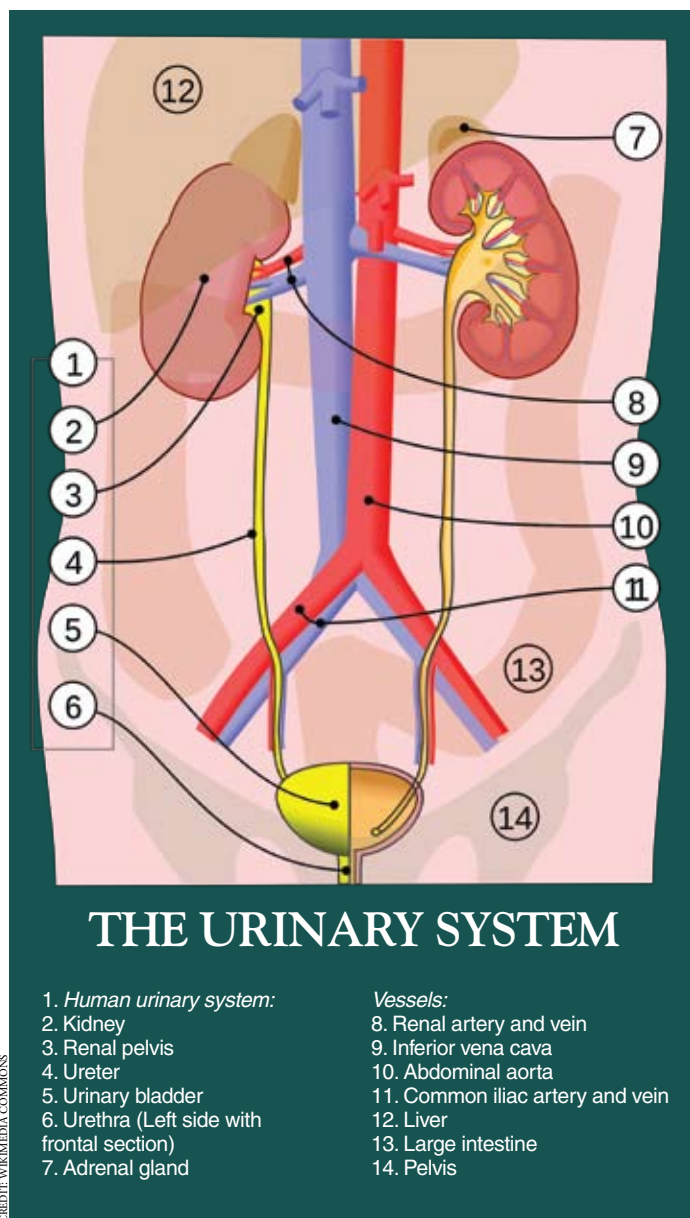
Renal anatomy

The urinary system has four main components—the kidneys, the ureters, the bladder, and the urethra. Urinary stone disease encompasses several types of stones found in several locations, though the common term for all of the locations is “kidney stones.”

- Renal stones are located in the kidney.
- Calyceal stones are found in the funnel-shaped area called the calyx between the kidney and the ureter, the tube that drains urine from the kidney to the bladder.
- Ureteral stones are located in the ureter. Stones are usually most painful when they migrate down, or are lodged in, the narrow part of the ureter. The narrowest area of the ureter is that portion that extends into the bladder, also known as the ureterovesicular junction (UVJ).
- Stones in the bladder do not usually cause symptoms unless they become lodged in the prostatic or penile urethra.
- “Saddle” stones extend from the calyx into several portions of the kidney and rarely pass spontaneously.

Composition of stones

Stones are made up of several different substances. Most stones are made of calcium oxalate, calcium urate, or



calcium pyrophosphate. Occasionally, stones are made of primarily uric acid, cysteine, or struvite. Calcium stones are usually visible on X-rays, while uric acid stones are nearly invisible.

The composition of the stones is important in locating them and deciding how to treat recurrent stones. Stone composition is determined by sending a stone strained from the urine for chemical analysis. A 24-hour urine collection can also be analyzed and compared to blood chemistries to determine if the kidney is excreting too much or too little of a compound leading to increased risk for stone formation. Kidney function is also measured using 24-hour urine analysis called creatinine clearance.

Symptoms and diagnosis

Urinary stones usually manifest as severe, acute pain on one flank or the lower back. Pain may radiate into the scrotum or testicle on the same side for men and into the groin area of the same side for women. Urinalysis may show microscopic blood that is not visible to the naked eye. Occasionally, a stone without any pain is detected after urinalysis shows blood, or

an X-ray that is taken for another reason shows a stone.

Diagnosis of a stone often is done with an X-ray. Some small stones are often difficult to find, even if the physician is specifically looking for the stone.

An intravenous pyelogram (IVP) involves injecting, into an arm vein, a dye that is collected and excreted by the kidneys, and whose presence appears on the X-ray film as a milky white area. The IVP shows an outline of the kidneys, calyces, and ureters. If a stone is blocking the ureter, the dye swells the ureter above the stone and may not pass into the ureter below the stone.

At times, computerized tomography (CT) scans are used to locate stones—particularly smaller stones that may not be visible on X-ray films or in emergency rooms.

Later evaluation of the cause of the stone may involve a 24-hour collection of urine to determine the concentration of certain chemicals known to provoke stone formation.

Treatments

Many treatments for stones exist. The FAA does not dictate a particular treatment for stones, so the agency will issue a clearance to return to flying after any treatment that the physician and the pilot agree to that eliminates the stone. As discussed below, the most conservative treatments involve spontaneous passage of the stone after oral or intravenous hydration. Adequate hydration by generous fluid intake is also a key element in preventing kidney stones.

Medical treatment for stones involves increasing urine output and pain relief. People with stones are instructed to drink large amounts of fluids (a gallon or more per day) to try to flush the stone through the urinary system. For those who may have enough pain to cause nausea and vomiting, an IV may be used to provide large amounts of fluids. Pain relief may require narcotics, especially as the stone moves down the ureter.

Extracorporeal shock wave lithotripsy (ESWL)

Stones of a certain size range located high in the urinary system that may not pass spontaneously are candidates for extracorporeal shock wave lithotripsy (ESWL). This procedure uses shock waves from several sources outside the body focused on the stone to fragment it into smaller pieces that can pass spontaneously.

Several techniques for lithotripsy are available. The procedure requires anesthesia, and many patients report considerable soreness after the ESWL. Often a stent, or hollow tube, is inserted into the ureter using a scope inserted through the bladder. The stent is to decrease the pain of the residual gravel from the shattered stone passing through the ureter. After all the fragments have passed, the stent is removed. Recovery and stone passage may take several days to weeks.

Ureteroscopic laser lithotripsy

Laser lithotripsy involves using a laser aimed directly at a kidney stone to fragment it so the smaller portions may pass through the kidney and ureters. The laser beam emanates from the tip of a flexible fiberoptic scope, which is manipulated through the bladder and up the ureter and into the kidney under visual control. Stents in the ureter are also frequently used as with ESWL.

Ureteroscopic stone removal (basket extraction)

Stones located lower in the collecting system (closer to the bladder) may be removed by a basket extraction technique. A probe is inserted through the urethra and bladder into the ureter. Using direct viewing through a fiberoptic scope, the surgeon grabs the stone and surrounds it by a clasp or expandable cage (basket) manipulated through the probe. The entire probe is removed, dragging the stone out with the probe.

Recovery usually takes place within several days. As with ESWL, a stent is sometimes left in place in the ureter for

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several days to allow healing. Not all stones are located in areas where this technique is practical.

Percutaneous nephrolithotomy

A more invasive procedure is percutaneous nephrolithotomy. This is usually reserved for stones in the kidney or calyx that are too large to pass and too large for ESWL. A small incision through the back and into the ureter is made to directly view the stone through a small scope. The stone is then removed through the scope. Sometimes the stone must be broken up to remove through the scope. The recovery time is somewhat longer for this procedure and may require several days in the hospital. As in basket extraction, the advantage over ESWL is that the stone is removed directly, rather than passing through the ureter.

Medications

If evaluation of the cause of stone formation reveals abnormal concentrations of certain substances in the urine or blood, medication may be prescribed to change the concentration and lower the risk of recurrent stone formation.

Medication to prevent recurrences of kidney stones includes the diuretic hydrochlorothiazide (HCZT), which decreases calcium excretion into the urine. Allopurinol (Zyloprim) is used to decrease uric acid production by the body and hence lower the concentration in the urine. The FAA may issue a waiver for either medication after an observation period free of side effects. Because HCZT lowers blood pressure and causes potassium loss, the FAA may require periodic reports, including blood tests for potassium, on future medical applications. Other medications may be prescribed to change the acidity or alkalinity of the urine and decrease the risk of developing stones. The FAA also may issue waivers for these medications.

Prevention

Preventing kidney stones is best accomplished by maintaining hydration. The dry environment of pressurized airplane



X-ray photo showing kidney stones.

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cabins predisposes pilots, flight attendants, and passengers to dehydration. A lack of a ready source of fluids and an unwillingness to frequently leave the cockpit to “attend to physiologic needs” during long flights also puts pilots at increased risk for dehydration and stone formation.

The airline pilot who has little time between flights, often sits on a hot ramp, and has physical work to perform associated with the flight may also get dehydrated. The general aviation pilot on a long cross-country without sufficient water carried aboard is also at risk.

The body is usually a liter dehydrated before a person becomes thirsty. A good rule of thumb is to drink enough to keep the urine clear. Pilots who have suffered through kidney stones rarely forget this rule.

Certain medications, such as Crixivan, are known to cause stones in some users. Certain foods that contain purines, oxalates, or calcium may place individuals at risk. Foods high in oxalates include rhubarb, asparagus, spinach, chocolate, tea, and coffee. Foods high in purines include organ meats (liver, brain), sardines, beans, beer, and red wine.

Not all people will benefit from restricting these foods, however. A 24-hour urine collection and analysis will aid your physician in recommending whether to restrict certain foods. If stones are composed of calcium oxalate or calcium phosphate, using HCZT may reduce the risk of recurrence. Risk of recurrence of stones of uric acid may be reduced by using allopurinol, which is sometimes used to treat calcium oxalate stones as well.

FAA policy

The FAA will certify a pilot who has had a single episode of kidney stones to fly after all stones are cleared, the patient is stable, and the FAA has received documentation required for clearance. Many AMEs are willing to clear a pilot also, if they have the appropriate documentation. The ALPA Aeromedical Office may also help a pilot return to flight duties after documenting that the stone has cleared.

The documentation should include reports of the evaluation and treatment, plus a report of X-ray confirmation that the pilot is stone-free. The following criteria usually must be met: The airman must (1) be free of stones, as indicated by X-ray, ultrasound, or CT, (2) have normal renal (kidney) function, and (3) show no sign of having metabolic stone disease.

Individuals with recurrent episodes of kidney stones are required to present information to the FAA that they are free of stones before returning to aviation duties. Recurrent episodes generally require a 24-hour urine analysis as well.

For those pilots who have retained stones that do not pass, the FAA will consider granting a waiver if their physician can affirm that the stone appears stable and is unlikely to pass spontaneously. Stones greater than 2 mm in diameter or those located in the upper or middle calyces are less likely to receive waivers. The hazard is that a retained stone may pass during flight and compromise flight safety.

AMEs may *not* clear individuals with a history of retained stones to return to flight duties after documenting that they are free of stones. Instead, authorization must be obtained from the FAA Aeromedical Certification Division (AMCD) or the FAA regional flight surgeon.

For the first episode of a stone, the FAA generally will not require follow-up reports from the pilot's personal physician on subsequent FAA medical examinations. Those with a history of recurrent or retained stones should expect to be required to submit these reports for several years at the time of their FAA medical examinations.

Getting help

The physicians at Aviation Medicine Advisory Service (AMAS), ALPA's Aeromedical Office, will answer questions and help ALPA members report kidney stones, or any other medical condition, to the FAA. AMAS's confidential aeromedical certification help is free of charge to ALPA members in good standing and is available Monday–Friday 8:30 a.m. to 4:00 p.m. Mountain Time by calling 303-341-4435. Information regarding FAA policy on kidney stones and many other conditions and medications is available on AMAS's website, www.AviationMedicine.com.

Stay hydrated! Fly safely! 🌊

For more information on aeromedical issues, go to www.alpa.org/aeromedical. Here you'll find issues of *Aeromedical Flyer*; information on radiation, fatigue, swine flu, and more; and links to ALPA's Aeromedical Research Center, the Centers for Disease Control, and the World Health Organization. 🌊