Minimally invasive techniques to treat urolithiasis require specialized equipment to fragment the stones, such as the Holmium:YAG laser.

The Holmium:YAG laser has not been successful in fragmenting all uroliths in horses, and smaller stones may be easier to fragment with this laser.

Other means for lithotripsy include ballistic and electrohydraulic lithotripters, but these cannot be used with flexible endoscopes.

The prevalence of urolithiasis in equines is thought to be low (0.04-0.7% of equines, depending on the sample population), and uroliths have been found most commonly in the bladder, but can occur anywhere within the urinary tract. Geldings and stallions are more commonly affected than mares, likely due to the smaller diameter of the urethra in males. Most uroliths in horses are made of calcium carbonate in calcite crystal form, with variable amounts of other minerals.1

A clinical workup for horses with urolithiasis should include a thorough ultrasound exam of the whole urinary tract, bloodwork to determine kidney function, as well as cystoscopy, in addition to a regular physical exam. After determination of location and size of the urolith(s), the feasibility of a minimally invasive approach should be assessed. Whether or not such approach is chosen will depend on availability of equipment, experience and comfort of the surgeon with the equipment, location and size of the urolith(s) and financial commitment of the owner.

Two challenges have to be overcome for the minimally invasive removal of uroliths: most stones will have to be fragmented effectively to be removed through natural orifices or small incisions, and removal of the fragments has to be reliable and complete. Minimally invasive devices to fragment stones include laser lithotripters, ballistic and electrohydraulic lithotripters, and possibly extracorporeal shockwave units and their use is described below with respect to lithotripsy of cystic calculi.

Laser lithotripsy in horses has been reported using the Pulsed Dye Laser (wavelength 504 nm)2,3 or the Holmium:YAG Laser (wavelength 2,100 nm)4 and it provides the advantage of fragmentation under visual guidance with a flexible endoscope, as both wavelengths can be transmitted via a flexible fiber. The Pulsed Dye Laser is very effective at fragmenting large uroliths, but because of its costly maintenance and the greater effectiveness of the Holmium:YAG Laser in human endourology, it is no longer available, to this author’s knowledge. The Holmium:YAG Laser has received mixed reviews with respect to its effectiveness at fragmentation of larger stones in horses.4-7 In 7 of the 15 reported cases, laser lithotripsy either did not affect the stone at all (3 of 7 cases), or resulted only in creation of a crater or groove (maximum 2cm deep) and laser lithotripsy was abandoned at that point (4 of 7 cases). In the remaining 8 of the 15 reported cases, fragmentation of the uroliths into fragments of maximum 1 cm diameter was successful. Possibly, smaller uroliths are more likely to be fragmented successfully than large uroliths, although urocystoliths as large as 12 cm in diameter have been fragmented successfully.7 Laser lithotripsy of cystic calculi is performed in standing, sedated horses via the biopsy channel of a flexible endoscope either through a perineal urethrotomy2,4,5,7 or through the urethra, even in male horses.6 Continuous lavage with saline solution facilitates visualization and prevents overheating of the bladder, although periodic lavage with the endoscope removed is oftentimes needed to regain adequate visibility of the
stone. Laser lithotripsy may be described as a tedious process, as surgery times oftentimes exceed several hours, depending on the size of the stone. Nevertheless, the decreased risk of bladder and urethral damage and the option to rent a laser from medical supply companies makes laser lithotripsy a viable option to consider when faced with urolithiasis in horses.

Ballistic and electrohydraulic lithotriptors can also be employed to fragment uroliths but they require a rigid endoscope with an operating channel \(^{8-12}\), which may or may not be easily available.

Extracorporeal shockwave lithotripsy using a radial shockwave unit (EMS Dolorcast, Nyon, Switzerland) has been used to fragment smaller uroliths within the urethra, providing a non-invasive methodology for fragmentation of urethroliths.\(^{13}\) Its use for fragmentation of uroliths in other locations has not yet been described in horses.

Removal of urolith fragments can be achieved via flushing or using endoscopic retrievers, such as wire baskets or prong graspers that are advanced through the biopsy channel of a flexible endoscope.

Although the most commonly encountered location of urolithiasis in horses is the bladder, uroliths within the urethra, the ureters or the kidneys certainly occur and present each their own challenges to the veterinary surgeon.

Although the minimally invasive removal of nephroliths has not been described in horses, in humans, extracorporeal shockwave lithotripsy is the initial procedure of choice.\(^ {14}\) Laser lithotripsy using a flexible endoscope introduced retrogradely into the kidney as performed in humans may not be practical in horses due to the inavailability of long enough flexible endoscopes with a small enough diameter. Finally, percutaneous nephrostomy followed by ballistic lithotripsy in humans is usually performed under fluoroscopic guidance, which is unattainable in adult horses.

Minimally invasive treatment of a ureteral stone using electrohydraulic lithotripsy through a rigid ureteroscope has been described in a horse \(^ {12}\), but this technique is unlikely to be successful for uroliths in the proximal ureters. Laser lithotripsy via a flexible endoscope appears feasible but also has not been described.

Radial extracorporeal shockwave lithotripsy in a gelding fragmented a urethrolith sufficiently for the fragments to be passed naturally through the urethra.\(^{13}\) Laser lithotripsy (using the Holmium:YAG laser) via a flexible endoscope appears to be more successful in horses for urethroliths than for larger cystic calculi.\(^6\)

In summary, minimally invasive approaches to resolve urolithiasis in horses can be successful, but require specialized equipment that may be available on a rental basis. Urinary calculi in the urethra, the urinary bladder and the distal ureters have been treated successfully using these minimally invasive techniques.

References: