# Case Report Rapport de cas

## Mouse barley awn *(Hordeum murinum)* migration induced cystolithiasis in 2 male dogs

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**Abstract —** Two male dogs were presented with cystic uroliths composed of magnesium ammonium phosphate (struvite). Each had an atypical nidus, a mouse barley awn *(Hordeum murinum)*. To our knowledge, this is the first report of grass awns located in the bladder lumen of dogs. The composition of uroliths and the pathophysiology of grass awn migration to the urinary bladder are discussed.

**Résumé — Cystolithiase induite par la migration de la barbe de l'orge des rats *(Hordeum murinum)* chez 2 chiens mâles.** Deux chiens mâles ont été présentés avec des urolithes cystiques composés de phosphate double d'ammonium et de magnésium (struvite). Chacun avait un nidus atypique, une barbe d'orge des rats *(Hordeum murinum)*. À notre connaissance, il s'agit du premier rapport de barbes d'herbe logées dans la lumière de la vessie de chiens. La composition des urolithes et la pathophysiologie de la migration de l'orge des rats vers la vessie sont discutées.

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### Case description

A urinary stone (urolith # 1) in a male 3-year-old Maltese dog with a history of hematuria and dysuria, was removed by cystotomy. In another veterinary clinic, a 1.5-year-old male mixed-breed dog, with a similar clinical history was subjected to the same surgical procedure for removal of a urolith (urolith # 2). The uroliths were submitted separately by the veterinary practitioners. Neither dog was reported to have had a previous episode of urolithiasis. Unfortunately we were unable to obtain information on the imaging studies, urinalysis, and urine culture.

A urolith may contain a nidus (area of obvious initiation of urolith growth), stone (major body of the urolith), shell (layer of precipitated material that completely surrounds the stone) and surface crystals (incomplete covering of the outermost surface) (1).

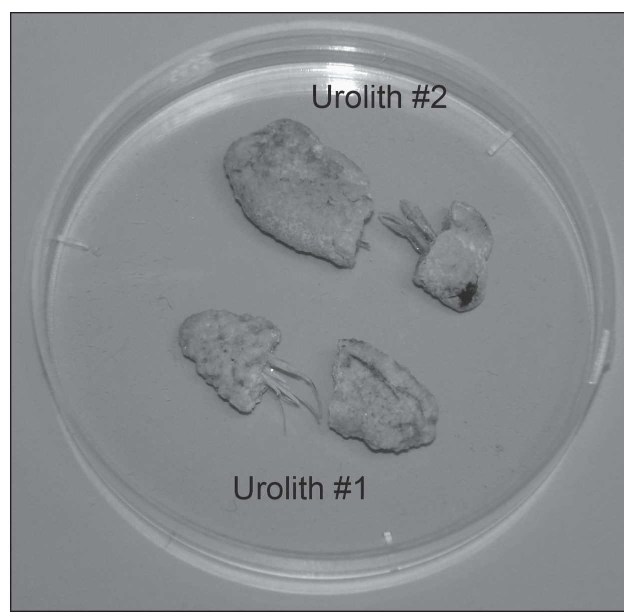


**Figure 1.** Uroliths with a nidus of plant material. The grass awn is clearly visible in urolith # 1.

After a careful visual examination, the uroliths were fractured in half for stereoscopic study (Zoom Stereomicroscope SWZ1500; Nikon Instruments, Tokyo, Japan). An ultramicrochemical examination (In vitro Diagnostic Reagent kit, Harzalith-I; Reanal Fine Chemical, Budapest, Hungary) and infrared spectroscopy (Infrared Spectrometer FT-IR 2000; Perkin Elmer, Buckinghamshire, United Kingdom) were used to

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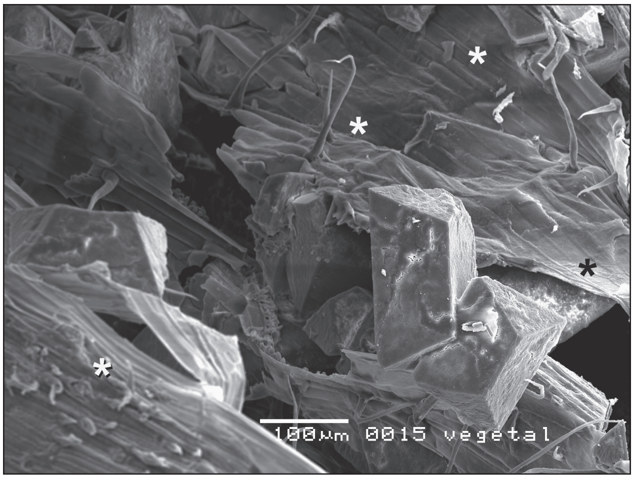


**Figure 2.** Scanning electron microscopy of uroliths. Asterisks – plant material.

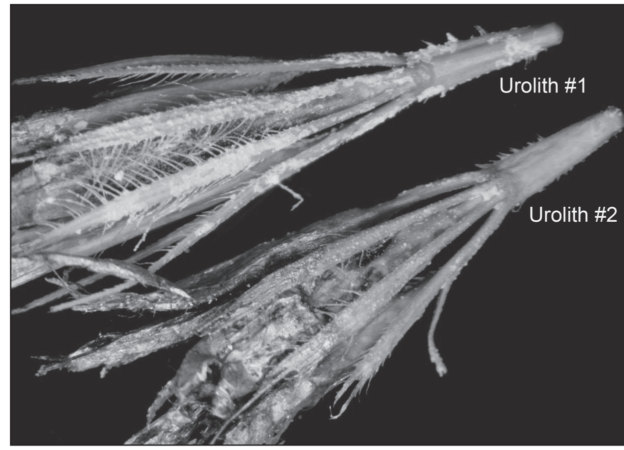


**Figure 3.** The grass awns of mouse barley *(Hordeum murinum)* found inside the uroliths.

determine the mineral composition. In both cases, a nidus with the typical morphology of plant material (in 1 case the image was clearly of a mouse barley awn) was observed (Figure 1).

Urolith # 1 measured $20 \times 8 \times 5$ mm, was whitish in color, and had an oval shape, a rough surface, and weighed 1.4 g. A grass awn was the nidus of the urolith. The layer surrounding the grass awn was composed of a mixture of struvite (80%) and calcium phosphate (20%). The outer layers were formed by struvite (100%).

Urolith # 2 also had a whitish color, an oval shape, and a rough surface; the dimensions were $25 \times 10 \times 6$ mm, and the weight 934 mg. All the layers of the urolith were composed of 100% struvite; a nidus of vegetable structure was identified. Bacteriological culture of the nidus of each urolith and surrounding mineral layers were negative.

Scanning electron microscopy (Scanning Electron Microscope Jeol JSM-6480LV, JEOL, Japan) showed the grass awns with microscopic spikes and hairs surrounded by calcium phosphate and struvite crystals (urolith # 1) or by struvite crystals alone (urolith # 2) (Figure 2).

The grass awns found inside both uroliths were identified as mouse barley *(Hordeum murinum)* (Figure 3) by the Department of Botany, Universidad de León.

## Discussion

Foreign objects affecting the urinary tract have only rarely been documented in dogs and cats (2–7) and horses (8). In a recent report of the Minnesota Urolith Center, foreign objects were found inside the uroliths in 0.25% of all samples (3). Suture material was the most common foreign object found in uroliths; but urinary catheters, hair, bullets, needles and plant material have been reported (2–10). The foreign objects can arrive in the urinary bladder by iatrogenic mechanisms (during surgery or urinary tract instrumentation), by retrograde movement up the urethra (6), by a transabdominal route (by migration from the skin) (5), or by a transvesical route (by migration from other abdominal structures) (6,7).

Knowledge of the mineral composition of the urolith is important for the clinical management, treatment, and prevention of urolithiasis. It is critical to know the composition of the nidus because it is the place where the urolith begins to form and a foreign object can act as a heterogeneous nidus (11). In the 2 cases herein the heterogeneous nidus (grass awn) was surrounded by struvite. Although struvite uroliths can form in a sterile environment, they are more commonly found in dogs that have a urinary tract infection caused by urease-positive bacteria (such as *Staphylococcus* spp. or *Proteus* spp.) because the resultant alkaline urinary pH reduces the solubility of magnesium ammonium phosphate (2,3). The foreign objects may promote bacterial proliferation due to the alteration in the defense mechanisms of the urinary tract. The information available on both clinical cases does not include any reference to urinary culture and, although the culture of the uroliths was negative, we cannot reject the possibility of the presence of a urinary tract infection when the urolith was formed.

Grass awns are especially adapted to the anterograde migration (anterior barbet florets on the surface force the grass awn to move forward and prevent retrograde migration). Usually the front part of the spike penetrates through the skin or body orifices, after being retained in the coat of the animal (12,13). The most common orifice of penetration is the external ear canal; penetration at cutaneous locations such as the dorsal interdigital webs is also common. However, penetration can occur at any site such as the soft tissues of the conjunctiva, the nictitating membrane, inside the eye (14), the nasal sinuses and oral cavity, the bronchial (15,16) and esophageal mucosa, bones (17) or the central nervous system (12,13,18). In many cases, the lesions have the appearance of abscesses.

Although grass awn migration is a common cause of foreign object-related disease in dogs, grass awn migration in the urinary system has only been reported in the urethra and not in the urinary bladder (6,9,10). If migration is retrograde up the urethra, as it seems to be in this study, it is practically impossible for the grass awn to be expelled during micturition because of their "open umbrella" shape (6). Just how plant awns gain access to the lumen of the urinary bladder is the subject of conjecture (3). To our knowledge this is the first report of mouse barley awn *(Hordeum murinum)* in the urinary bladder in dogs. Retrograde migration of grass awns up the urethra should be considered in the diagnosis of foreign objects in association with cystolithiasis.

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