Understanding Kidney Stones—Dalmatians Lead the Way

The role of inhibitory macromolecules in preventing crystallization of uric acid and formation of kidney stones continues to perplex investigators. Dalmatians are a breed well-known for high levels of uric acid excretion and stone formation. In this study, urine samples were collected via transurethral catheterization at two 12-hour intervals from 10 stone-forming Dalmatians and 5 age-matched Dalmatians without kidney stones. The urinary inhibitors Tamm-Horsfall protein (THP), glycosaminoglycans, and nephrocalcin were isolated and measured. Levels of pH, ammonia, calcium, citrate, creatinine, magnesium, oxalate, sodium, and uric acid were also measured. Other purine metabolites were studied by high-performance liquid chromatography.

As expected, both stone-forming and healthy Dalmatians excrete large amounts of uric acid. No other metabolites were derived from purine in their urine. Stone-forming Dalmatians showed significantly lower urinary excretion of THP than their normal counterparts as well as an insignificantly lower excretion of glycosaminoglycans. Inhibition of calcium oxalate monohydrate crystal growth by nephrocalcin isoforms were on the same order of magnitude (about 10^-7) for both stone-forming and healthy Dalmatians. These results confirm the Dalmatian as an in vivo model for investigation of the interrelationship of urine inhibitors against the formation of kidney stones.

COMMENTARY: It has been known for some time that daily excretion of uric acid in stone-forming Dalmatians was the same as that of Dalmatians that did not form stones. This study may shed some light on this mystery in that stone-forming Dalmatians appeared to have lower rates of excretion of urinary THP, an inhibitor of crystallization. However, the cause of the reduced rate of excreted protein remains unclear.—David F. Senior, BVSc, Diplomate ACVIM & ECVIM-CA