Animal Models for the Study of Human Disease: Chapter 21. Animal Models of Calcium Oxalate Kidney Stone Formation

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Most kidney stones consist of crystals of calcium oxalate (CaOx) and/or calcium phosphate (CaP), and develop on nidi present on renal papillary surfaces. Stone formation is the last stage in a long process starting with development of supersaturation followed by nucleation, growth, aggregation and retention of crystals within the kidneys. A number of animal models utilizing mice, pigs, rabbits and rats, (the most common model), have been developed to understand stone pathogeneses. Animals produce crystalline deposits in the kidneys rather than typical stones attached to the papillary surface. Still, there are many common features between human and rat CaOx nephrolithiasis. Both kidney stones in humans and crystal deposits in the rats have an organic matrix comprised of lipids, carbohydrate and proteins. The crystallization in both human and rat kidneys is modulated by molecules such as osteopontin, Tamm–Horsfall Proteins, inter-alpha-inhibitor, and prothrombin fragment-1 and is associated with enzymuria of proximal tubular origin. Hyperoxaluria, hypercalciuria, hypomagnesuria and hypocitraturia are implicated in both humans and rats. CaOx stones/renal deposits are common in males of both species while females of both species produce CaP stones/renal deposits.

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