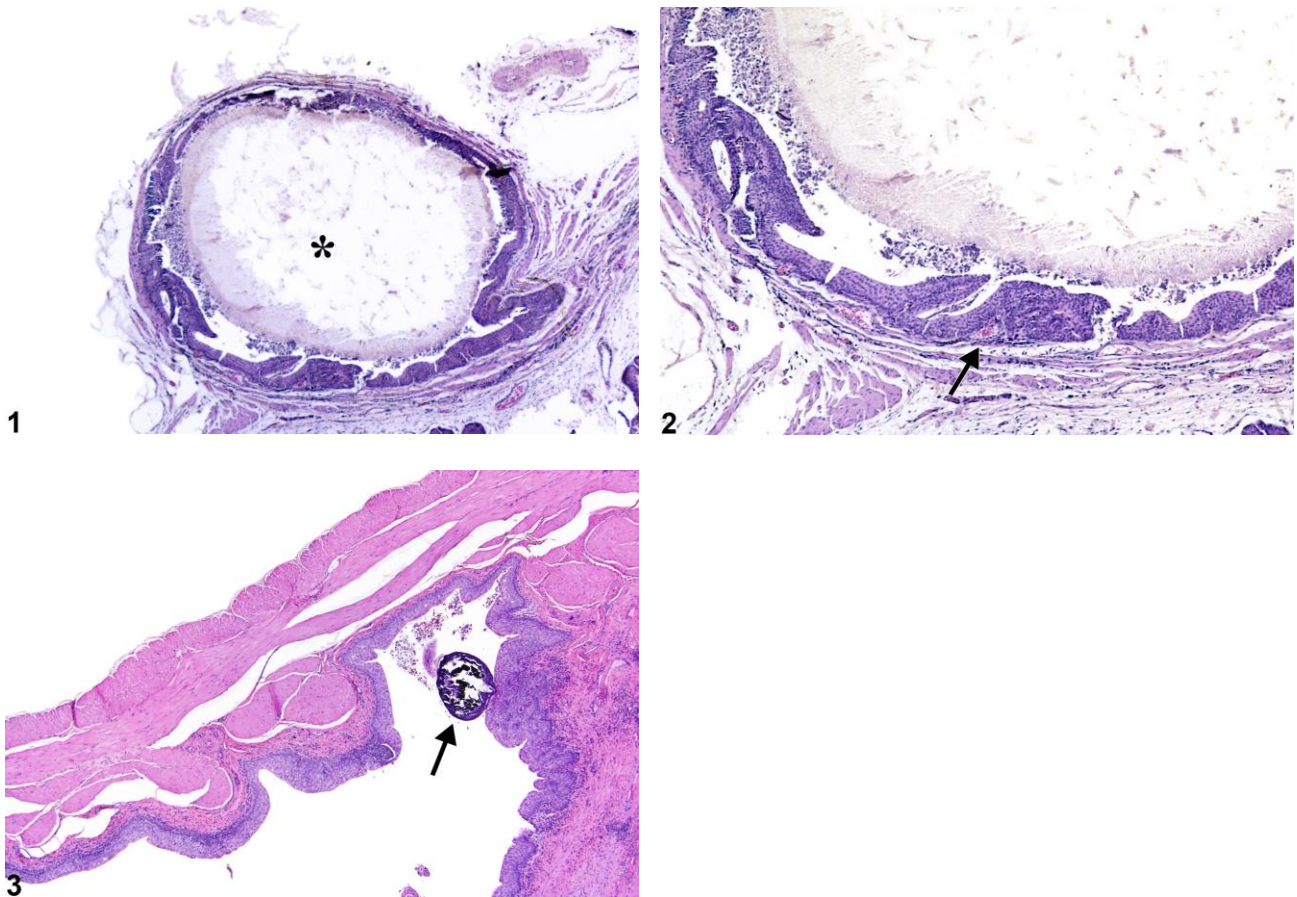




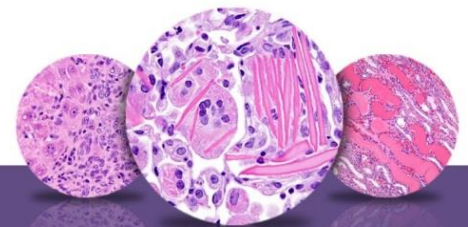
# NTP Nonneoplastic Lesion Atlas

## Urinary bladder – Calculus Urinary bladder – Crystal



**Figure Legend:** **Figure 1** A calculus (asterisk) fills the entire bladder lumen in a male F344/N rat from a chronic study. **Figure 2** Hyperplasia of the urothelium (arrow) due to the presence of the calculus in a male F344/N rat from a chronic study. **Figure 3** A small basophilic calculus (arrow) associated with chronic inflammation and urothelial hyperplasia in a female Harlan Sprague-Dawley rat from a chronic study.

**Comment:** *Calculi* may be seen as spontaneous or as chemically induced lesions. Calculi may be single or multiple (Figure 1). Gross examination of the bladder is important since some small calculi may be washed out of the bladder when processed for histopathology. Calculi result from the precipitation of normal constituents or chemical compounds/metabolites associated with changes in urinary pH or other conditions. Frequently in the rodent, calculi contain some form of



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calcium or mineral complex. Calculi often result in necrosis, ulceration, inflammation, and hyperplasia of the urothelium (Figure 2 and Figure 3). They are often the cause of bladder obstruction. In addition, bladder neoplasia may result from the presence of calculi. The presence of *crystals* and the subsequent appearance of calculi are often associated. Strain differences in the presence of crystals have been reported. Crystals, like calculi, tend to be washed out during histologic processing.

**Recommendation:** Calculi and crystals should be diagnosed but should not be graded. Calculi are usually associated with secondary lesions, such as hemorrhage and inflammation. The pathologist should use his or her judgment in deciding whether or not these secondary lesions are prominent enough to warrant a separate diagnosis. Since calculi may induce neoplasia, a separate diagnosis of hyperplasia is warranted.

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## *Urinary bladder – Calculus* *Urinary bladder – Crystal*

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### Authors:

John Curtis Seely, DVM, DACVP  
Senior Pathologist  
Experimental Pathology Laboratories, Inc.  
Research Triangle Park, NC

Abraham Nyska, DVM, Diplomate ECVF, Fellow IATP  
Expert in Toxicologic Pathology  
Visiting Full Professor of Pathology  
Sackler School of Medicine, Tel Aviv University  
Timrat Israel