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Imaging and chemical analysis of ureteral stent encrustation and incrustation

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Ureteral stents are effective in alleviating flow disruptions in the urinary tract, whether due to ureteral stones or either intrinsic or extrinsic ureteral obstruction. Stents are also used following various endourological and surgical procedures that can affect the ureter, to promote urine flow until edema decreases and incisions heal. However, significant stent encrustation and incrustation can occur, which may interfere with stent functioning and/or removal. The goal of this work was to quantify stent encrustation and incrustation, mapping depositions along the entire length of representative, intact stents. This information was used to identify possible correlations between encrustation and incrustation, and to examine potential stent lumen obstruction resulting from incrustation. Micro-computed tomography (micro-CT) was used to non-invasively image encrustation (stent external wall) and incrustation (stent lumen). Subsequently, x-ray diffractometry (XRD) and scanning electron microscopy–energy dispersive x-ray spectroscopy (SEM-EDS) enabled analysis of samples of encrusted and incrusted material collected from the distal, proximal and mid-ureteral stent regions, to characterize the mineral structure and chemical content of the deposits. The micro-CT analysis shows, most significantly, that extensive *incrustation* can occur along any region of a stent, even when there is only incidental or minor *encrustation* along the entire length of the (exterior) stent wall. Analysis of mineral structure and chemical content demonstrates the occurrence of broad variations among individual stents. Deposits can consist of crystalline deposits (e.g., $CaCO_3$) and/or amorphous, non-crystalline, organic and/or inorganic constituents. A clinical implication of our findings is as follows: given that the degree of incrustation cannot be predicted or determined in advance, and in the absence of any other correlating clinical data, the practice of inserting a guidewire into the stent to facilitate its direction to the kidney may result in inadvertent delivery of large amounts of depositional material into the upper urinary tract. Such deposits may act as nucleation material for future kidney stones. Moreover, deposits containing significant amounts of organic/biological constituents may lead to contamination of the urinary tract and potentially to bacteremia under high renal pressures.

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References

Time Block Preference

Time Block A (09:00-12:00 CET)

Participation

Unsure

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