

STONE DISEASE

The digital flexible ureteroscope: in vitro assessment of optical characteristics

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Introduction: Recent advances in endoscope design have placed the charged coupled device chip on the tip of the endoscope. The image is instantly digitalized and converted into an electrical signal for transmission. Digital technology was first introduced into flexible cystoscopes/nephroscopes and subsequently into rigid and flexible ureteroscopes. Herein, we assess the image characteristics and advantages of a new generation of digital flexible ureteroscopes.

Methods: The Olympus URF-V flexible digital ureteroscope and the Olympus URF-P3 fiberoptic ureteroscope were assessed in vitro for image resolution, distortion, color representation, grayscale imaging, field of view, and depth of field.

Results: The digital ureteroscope had a higher resolution at 3, 5, 10, and 20 mm (25.2 lines/mm vs. 8.0, 14.1 vs. 5.0, 6.3 vs. 2.8, and 3.2 vs. 1.3), respectively. Distortion with the digital flexible ureteroscope was lower, though not statistically significant. Color representation was better with the digital ureteroscope, whereas contrast evaluation was comparable between both scopes. The digital flexible ureteroscope produced a 5.3 times larger image size compared with the standard fiberoptic flexible ureterscope with a narrower field of view. The depth of field was limited by light and not the optic or the camera for both ureteroscopes.

Conclusions: The development of digital flexible ureteroscopes represents a significant technological advance in urology. These devices offer significantly improved resolution and color reproduction as compared with traditional fiberoptic flexible ureteroscopes. Future clinical trials are warranted to ultimately determine the advantages of these innovative endoscopes.

Editorial Comment

The authors conducted a comprehensive evaluation of a new digital flexible ureteroscope, however unfortunately they compared it to an old-generation fiberoptic scope - the URF-P3; it would have been preferable to evaluate the latest generation fiberoptic scope, the URF-P5. Despite this limitation, they noted some significant differences, and some significant similarities between the two scopes. Both modalities provided good image contrast and minimal distortion, as well as good color representation and depth of field. While image quality (resolution, image size) was superior with the digital scopes, certain characteristics that may impact ease of maneuvering and navigating (small scope size, larger field of view) was superior for the fiberoptic scope. The relative value of improved resolution and larger image (digital scopes) compared to the relative value of a larger field of view and smaller scope size (fiberoptic scopes) warrants a clinical trial. 8.5F at the tip.

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