STONE DISEASE

doi: 10.1590/S1677-55382010000600016

Evaluation of optimal color for stent identification in a hemorrhagic environment

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J Endourol. 2010; 24: 1515-9

*I*ntroduction: The endoscopic deployment and extraction of endoluminal stents, such as ureteral stents, is commonplace in contemporary medical management of many diseases. In a hemorrhagic environment, endoscopic identification of a stent can be challenging. To date, no study has evaluated the optimal color for endoscopic stent identification.
Methods: Eight different colored stents were placed in a simulated bladder model. Each stent color was evaluated in saline and three progressively more concentrated bloody environments. A flexible cystoscope was used to make 15-second video clips of the stents in each environment. Participants viewed the videos in a random sequence. Participants were asked to identify the color of each stent, and rate the identification on a 10-point scale. Logistic regression models were used to model the relationship between identification, stent color, environment, and experience.
Results: Forty-seven participants reviewed the videos. In clear and mildly bloody environments, blue stents had the highest identification ($p < 0.06$, $p = 0.001$, respectively). In moderately bloody environments, yellow stents had the highest identification ($p < 0.01$), whereas silver stents had the highest identification in severely bloody settings ($p = 0.004$). Blue and green stents were identified most commonly and received the highest identification scores in all environments. Level of training and experience with endoscopy were not significantly associated with the correct response rate.
Conclusions: This study demonstrates that the color of a stent plays an important role in endoscopic identification. Our results suggest that blue and green colors offer superior visibility in both clear and hemorrhagic environments.

Editorial Comment

The authors have identified an issue that may be a critical consideration for devices utilized in endoscopic, laparoscopic and robotic procedures. For example, identification of color in a hemorrhagic environment would be important for such instruments as laser fiber coatings and aiming beams, laparoscopic clips and staplers, suction tips, and vascular clamps. As such, this work paves the way for further evaluations of a wide variety of instrumentation in an endoscopic and laparoscopic environment that utilizes fiberoptic or digital imaging technology.

This study suggests that if a stent is being placed at the end of a procedure associated with significant bleeding, one should consider the use of a yellow or silver stent to minimize the risk of inadvertently advancing the stent beyond the ureteral orifice. Otherwise, blue and green lets the stent be seen.

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