Miniature Camera for Enhanced Visualization for Single-Port Surgery and NOTES

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Abstract

Objective: Natural orifice transluminal endoscopic surgery (NOTES) and single-port surgery (SPS) have maximized the enhanced aesthetic profile of laparoscopic surgery. Nevertheless, these modalities also accentuate the inherent limitations of subvisiblity and decreased instrument dexterity of motion. The goal of this study was to evaluate the utility of a miniature laparoscopic camera to alleviate these obstacles.

Materials and Methods: A miniature laparoscopic camera was inserted via an endoscopic working channel or embedded into laparoscopic tools. Following laparoscopic trainer studies, operations were conducted on pigs using standard laparoscopic, SPS, and NOTES approaches. Additionally, the camera was used to perform colonoscopies on mice, rats, and pigs.

Results: The camera enabled visualizing the dissection area behind the renal vessels during laparoscopic nephrectomy and in the Triangle of Calot in laparoscopic cholecystectomy while providing accurate and detailed visualization of the operative field. The camera was successfully passed through the working channel of a standard gastroscope and used during NOTES procedures. It was used during colonoscopy to evaluate the distal colon in pigs and allowed the diagnosis of small colonic polyps with good image quality. Additionally, it could be easily passed beyond colonic strictures created in a porcine model. Finally, its miniature size enabled performance of colonoscopies on rats serving as animal models for colonic polyps.

Conclusions: The miniature laparoscopic camera provides adequate images with enhanced visibility in conventional laparoscopic, SPS, and NOTES procedures. We believe that this device or similar miniature cameras may greatly aid the future development of NOTES and SPS by enhancing the safety and ease of performing these procedures. Further development is being conducted in order to integrate this camera into standard instruments and to allow an even better image quality.