

A COMPARATIVE STUDY OF IMAGE QUALITY IN SCARLESS SURGICAL TECHNIQUES: NOTES AND LESS

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Background: Minimally invasive surgery has evolved, looking for new surgical approaches that lead to fewer scars, less perioperative pain, and less post-operative period for the patient. Some of these are the Natural Orifice Transluminal Endoscopic Surgery (NOTES) and Laparo-Endoscopic Single-Site Surgery (LESS). Despite their broad benefits, they have some drawbacks such as the loss of deep perception, the increase of technical difficulties and the need of specialized instruments. In addition, there are other challenges with regard to the quality and reliability of the image provided to the surgeon.

Purpose: The aim of this work is to develop two methods to quantify and evaluate two critical factors for the image quality and reliability: image distortion and noise. It will be analyzed and quantified which surgical approach, NOTES or LESS, provides the best image quality to the surgeon and the most reliable with regard to these factors.

Material and methods: A double-channel flexible endoscope (13806PKS; Karl Storz GmbH&Co, Germany) was used for NOTES. The image capture system for LESS consisted of a laparoscopic camera (Image1-HD; Karl Storz GmbH&Co, Germany) and an optic (26007-AA; Karl Storz GmbH&Co, Germany) of 0 degrees, 5 mm of diameter and 30 cm of length. The image distortion parameters (radial and tangential distortion and deviation of the image center) and the white Gaussian noise were computed for both surgical approaches. For distortion parameters four image capture systems with identical technical features previously mentioned were analyzed for each surgical technique. Furthermore, three video sequences of a cholecystectomy by NOTES and three by LESS were analyzed to compute the image noise.

Results: Results for LESS and NOTES were respectively: 122.480 ± 63.295 and 225.429 ± 25.487 pixels for the maximum mean deviation of pixels in the image; 8.579 ± 1.954 and 44.537 ± 1.173 pixels for the mean deviation of pixels; 29.729 ± 7.249 and 15.631 ± 2447 pixels for the mean deviation of the image center; 8.875 ± 5.381 and 7.739 ± 2.478 for the mean variation of noise (σ_N^2).

Conclusions: Image capture systems for LESS cause less distortion in the image than systems for NOTES. There were not significant differences in the image noise levels between the image systems of both surgical approaches.