Endoscopic visualization

Three-dimensional (3-D) endoscopy

Three-dimensional (3-D) endoscopy is a recent addition to augment the transsphenoidal approach for anterior skull-base and parasellar lesions.

Over an 18-month period, 160 operations were performed using solely endoscopic techniques. Sixty-five of these were with the Visionsense VSII system 3-D endoscope and 95 utilized 2-dimensional (2-D) high-definition (HD) Storz endoscopes. Intraoperative and postoperative findings were analyzed in a retrospective fashion.

Comparing both groups, there was no significant difference in total or surgical operating room times comparing the 2-D HD and 3-D endoscopes (239 minutes vs 229 minutes, P = .47). Within disease-specific comparison, pituitary neuroendocrine tumor resection was significantly shorter utilizing the 3-D endoscope (surgical time 174 minutes vs 147 minutes, P = .03). These findings were independent of resident or fellow experience. There was no significant difference in the rate of complication, reoperation, tumor resection, or intraoperative cerebrospinal fluid leaks. Subjectively, the 3-D endoscope offered increased agility with 3-D techniques such as exposing the sphenoid rostrum, drilling sphenoidal septations, and identifying bony landmarks and suprasellar structures.

The 3-D endoscope is a useful alternative to the 2-D HD endoscope for transnasal anterior skull-base surgery. Preliminary results suggest it is more efficient surgically and has a shorter learning curve. As 3-D technology and resolution improve, it should serve to be an invaluable tool for neuroendoscopy [1)].

Although the potential benefits of 3-dimensional (3-D) vs 2-dimensional (2-D) and high-definition (HD) vs standard-definition (SD) endoscopic visualization have long been recognized in other surgical fields, such endoscopes are generally considered too large and bulky for use within the brain.

The development of 3-D and HD neuroendoscopes may therefore herald improved depth perception, better appreciation of anatomic details, and improved overall surgical performance.

Ten novice neuroendoscopic surgeons were recruited from a university hospital. A preclinical randomized crossover study design was adopted to compare 3-D vs 2-D and HD vs SD neuroendoscopy. The primary outcomes were time to task completion and accuracy. The secondary outcomes were perceived task workload using the NASA (National Aeronautics and Space Administration) Task Load Index and subjective impressions of the endoscopes using a 5-point Likert scale.

Time to task completion was significantly shorter when using the 3-D vs the 2-D neuroendoscopy (P = .001), and accuracy of probe placement was significantly greater when using the HD vs the SD neuroendoscopy (P = .009).

3-D endoscopy significantly improved perceived depth perception (P < .001), HD endoscopy significantly improved perceived image quality (P < .001), and both improved participants' overall impression (P < .001).

Three-dimensional neuroendoscopy and HD neuroendoscopy have differing but complementary effects on surgical performance, suggesting that neither alone can completely compensate for the lack of the other. There is therefore strong preclinical evidence to justify 3-D HD neuroendoscopy [2)].

1)
Barkhoudarian G, Del Carmen Becerra Romero A, Laws ER. Evaluation of the 3-dimensional endoscope in transsphenoidal surgery. Neurosurgery. 2013 Sep;73(1 Suppl Operative):ons74-8; discussion ons78-9. doi: 10.1227/NEU.0b013e31828ba962. PubMed PMID: 23407288.
2)
Marcus HJ, Hughes-Hallett A, Cundy TP, Di Marco A, Pratt P, Nandi D, Darzi A, Yang GZ. Comparative Effectiveness of 3-Dimensional vs 2-Dimensional and High-Definition vs Standard-Definition Neuroendoscopy: A Preclinical Randomized Crossover Study. Neurosurgery. 2014 Apr;74(4):375-81. doi: 10.1227/NEU.0000000000000249. PubMed PMID: 24220007.