

No tracking system replaces good seamanship

Endoscopic sinus surgery is one of the frequently performed procedures in otolaryngology and is the treatment of choice for various forms of sinonasal disorders⁽¹⁾. However, because of the close proximity of the paranasal sinuses to orbital, neurovascular, and intracranial structures, there remains a definite risk of complications associated with this procedure. This risk becomes even greater in case of revision surgery or extensive disease in which the anatomic landmarks are absent or difficult to identify. In an attempt to improve surgical accuracy and safety, computer-aided surgery (CAS) systems have been developed to help the surgeon with anatomic localization. Although in the USA it is discussed whether CAS should be "standard of care" especially in revision cases^(2,3), it is a question of debate whether the use of navigation systems improves surgical outcomes or reduces complications.

In experienced hands the mean target registration error of most systems is around 2 mm with a 95% CI of another 2 mm and a maximum value of 5 - 6 mm⁽⁴⁾, although overall accuracy diminishes from anterior to posterior⁽⁵⁾. In this issue of *Rhinology*, Tschopp and Thomaser compared sphenoidectomies done without CAS (n=113) and with CAS (n=109)⁽⁶⁾. Although the authors point out that their numbers are insufficient to find statistically significant differences, they do share some interesting observations. The first is that the operation time was not prolonged by CT navigation. The second that, contrary to findings of Reardon et al.⁽⁷⁾ who showed significantly more frontal sinuses to be opened using CAS, not more sinuses were opened in the CAS group compared to the ones without. Thirdly, three complications occurred in the "without CAS" group compared to only one in the CAS group.

At least as interesting as the discussion whether CAS improves surgical outcomes or reduces complications is the discussion about potential risks. Critics of CAS argue that the use of these systems builds dependence on them for anatomic identification and gives the surgeon unjust confidence. Especially in revision cases or extensive disease and in the more posterior part of the sinuses the importance of anatomic knowledge cannot be overemphasized.

At this moment few authors have looked at the use of CAS in relatively inexperienced hands. Also CAS seems to be more reliable anterior (easy to check by the surgeon) than posterior which further increases the risks⁽⁵⁾. Before discussing whether CAS should be "standard of care" we need studies where CAS is used in (inexperienced?) surgeons who felt that CAS made their surgery more complete and see the complications.

Although CAS certainly has its risks it can be very helpful in difficult cases reaching/ perforation the skull base. New developments in CAS appear regularly. In this issue Cavarsacio⁽⁸⁾ presents the preliminary results of a novel augmented reality system for endoscopic surgery (ARES) that is able to highlight hidden structures or CT overlays in the endoscope. Different modalities of synthetic image viewer, such as

a CT viewer that provides the surgeon with CT images overlapping to the endoscope video or a 3D viewer able to render 3D models of pre-operatively segmented structures, such as tumors or risk regions have been developed. These new developments point to perfect surgery without complications in the endoscopic sinus and skull base surgery of the future. However no tracking system replaces good seamanship.

REFERENCES

1. Fokkens WJ, Lund VJ, Mullol J, et al. European Position Paper on Nasal Polyps 2007. *Rhinology*. 2007; 45; suppl. 20: 1-136.
2. Hepworth EJ, Bucknor M, Patel A, et al. Nationwide survey on the use of image-guided functional endoscopic sinus surgery. *Otolaryngol-Head Neck Surg*. 2006; 135, 68-75.
3. Marple BF, Setzen M. Image-guidance technology: What type of information best guides its appropriate use? *Otolaryngol-Head Neck Surg*. 2006; 135, 75.
4. Labadie RF, Davis BM, Fitzpatrick JM. Image-guided surgery: what is the accuracy? *Curr Opin Otolaryngol & Head Neck Surg*. 2005, 13: 27-31.
5. Ledderose GJ, Stelter K, Leunig A, Hagedorn H. Surface laser registration in ENT-Surgery: accuracy in the paranasal sinuses - a cadaveric study. *Rhinology*. 2007; 45: 281-285.
6. Tschopp KP, Thomaser EG. Outcome of functional endonasal sinus surgery with and without CT-navigation. *Rhinology*. 2008; 46: 116-120.
7. Reardon EJ. Navigational risks associated with sinus surgery and the clinical effects of implementing navigational systems for sinus surgery. *Laryngoscope* 2002; 112: 1-19.
8. Caversaccio M, Jaime Garcia Giraldez JM, Thoranaghate R. Augmented reality endoscopic system (ARES): preliminary results. *Rhinology*. 2008; 46: 156-158.



Wytske J. Fokkens
Associate Editor