Developments in image-guided neurosurgery

Sir,

I have read with great interest the article by Wadley et al (Vol 60(1), 1999, p 34) and would like to congratulate the authors on a comprehensive review of this evolving technology. However, I feel it is necessary to point out further developments in this rapidly changing field.

One of the most important and practical developments in this field is linking the optical tracking technology they have described to a virtual pointer (the focal length of the surgical microscope) and contouring the target, areas of interest and risk zones. This small step in the right direction not only enhanced the surgeon's performance but also improved the accuracy of patient to image and image to image registration.

Our group has achieved similar results using a mechanical pointer (Eljamel, 1997), but we felt this technology could do better. Hence, since January 1998 we used a virtual pointer (Zeiss SMN) with head-up display. The use of non-touch technique during registration has improved the accuracy of the system and the head-up display has provided continuous feedback navigation information to the operating surgeon without the need to look away from the operative field. With the mechanical pointers described by the authors, the operating surgeon must touch the fiducials during registration and the target during navigation and look away from the surgical field to get the feedback information from the computer workstation. This not only deforms the touched target and fiducial but also interrupts the flow of surgery.

Neuropsychologists have demonstrated that surgical performance is better when the surgeon is looking down onto the operative field rather than at a monitor, hence most neuronavigation systems have either linked to the surgical microscope with head-up display or a plasma display within the operative field.

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Eljamel MS (1997) Accuracy, efficacy and clinical applications of the Radionics operating arm system. *Computer Aided Surgery* **2:** 292–7

Sir,

I am most grateful to Mr Eljamel for his comments regarding our review of contemporary image guidance in neurosurgery. He correctly points out that in conjunction with 'pointer'-based interactive image-guided neurosurgical systems that utilize a hand-held tool for intraoperative localization, as described in the article for the system that our group has developed, there are alternative methods of both digitization and localization.

Mr Eljamel mentions the use of the Zeiss SMN system, a commercially available instrument that incorporates a superimposed outline of the chosen target in the eyepiece of the microscope, providing the surgeon with a visible contour of the lesion. This is not actually a new concept or further development, and as stated in our article, the very first system pioneered by Roberts in 1985 introduced the concept of interactive image guidance integrated with an operating microscope. Most of the microscope-based systems that are now available on the market also have a computer monitor displaying graphical data and also utilize pointers as a second method of localization.

This is simply a different approach to achieve similar goals, but we would disagree with Mr Eljamel that the use of the microscope as a guidance tool offers any particularly significant advantages. There are a number of problems with the use of a navigating microscope over more straightforward pointer-based systems, and most of the groups worldwide that have pioneered this technology, such as our own (Breeuwer et al, 1998; Wadley et al, 1998a), prefer the latter. Microscope systems are considerably more expensive and it must be remembered that they may be rendered useless if the case requiring guidance does not require magnification, as is the case with a large number of intracranial operations.

We believe that the head-up display may actually be a distraction to the surgeon, and since the incorporated image is merely an outline, the surgeon may still have to refer to the more detailed images on the workstation screen. In addition, the outline is not a 3-dimensional segmentation and thus does not change in shape or size as different depths of the tumour are encountered. Since the outline projection is still vulnerable to the distortions caused by 'brain-shift', these points may also mean that there is potential for surgical error.

Solely microscope-based systems do not enable other tools and techniques such as the integration of neuroendoscopes (Wadley et al, 1998b), insertion of ventricular catheters (Wadley et al, 1998a) or highly accurate interactive biopsy tools (Alberti et al, 1998; Wadley et al, 1998c).

There is no published evidence that alternative methods of registration are any more or less accurate and our detailed studies in over 400 cases as well as mathematical modelling indicate high levels of application accuracy with the correct positioning and distribution of scalp fiducials (Alberti et al, 1998; Wadley et al, 1998c; Thomas and Wadley, 1998).

As stated at the end of our review, we believe that the future lies with modular neuronavigation systems that will incorporate the microscope as an optional feature rather than the sole method of digitization and localization.

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Fluoxetine and eating disorders

Sir,

Cookson and Duffett's review of fluoxetine (Vol 59(8), 1998, p. 622) is to be welcomed for its breadth and clarity. Nonetheless I would like to qualify their statement that fluoxetine is 'not recommended in anorexia nervosa'. While this is probably true of the emaciated anorectic, it appears hopeful that fluoxetine may have a role in relapse prevention for the weight-restored anorectic. In an open trial, Kaye et al (1991) described good weight maintenance over 11 months in 31 weight-restored anorectics prescribed fluoxetine. In a double-blind placebo-controlled trial of fluoxetine given to weight-restored anorectics, Kaye et al (1996) reported that 63% of subjects on fluoxetine (n=16) but only 16% on placebo (n=19) remained well at 1 year follow-up.

While it would be premature on the basis of such limited studies to advocate fluoxetine for all 'recovered' anorectics, fluoxetine may prove to have a limited role in relapse prevention Larger controlled studies with good outcome measures are needed to to examine this hypothesis.

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