

Introduction

Intraoperative ultrasonography (IOUS) for pituitary tumors was pioneered by Oldfield *et al*, who showed greater detection and remission rates in cases of Cushing's disease (1). In addition to detection and resection of microadenomas, IOUS has proved beneficial in identifying macroadenomas, pituitary cysts, and craniopharyngiomas as well as normal sellar and parasellar structures(2). Here, the authors describe the use of a novel sterile, disposable, 2.86 mm diameter side-firing 6.6 to 13.0 Mhz ultrasound probe for the use in transsphenoidal pituitary surgery.

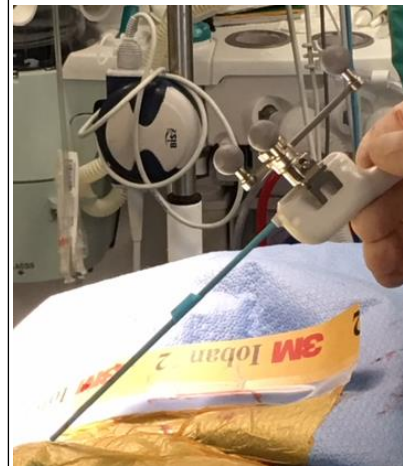
Methods

Patients with pituitary region lesions were retrospectively reviewed over a 3 year period. 84 cases were identified, 16 of which were performed with IOUS. Data was analyzed for complications (CSF leaks, postoperative pituitary dysfunction, and blood loss), length of hospital stay, extent of resection and associated costs related to the surgery and postoperative course.

Results

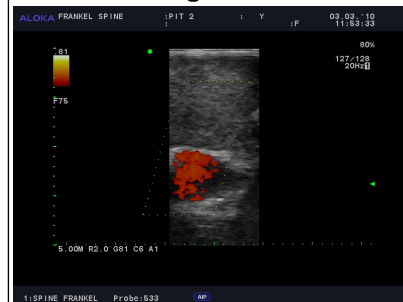
There were no significant differences in patient age, gender, tumor volume, Knosp grade, or recurrent vs. primary tumor presentation between the two groups. On univariate analysis patients treated using IOUS had significantly higher rates of GTR (75% vs. 49%, $p < 0.05$), shorter operating room time (77 vs. 148 min, $p < 0.01$), and lower blood loss (159 vs. 304 cc, $p < 0.05$). Multivariate analysis confirmed significance of IOUS as an independent predictor of GTR and diminished operative time, regardless of surgical approach. Additionally, there was a trend toward lower rates of intraoperative cerebrospinal fluid leakage (25% vs. 50%, $p = 0.06$) and shorter hospital length of stay (3.1 vs. 4.2 days, $p = 0.09$) in the IOUS group; however, this did not reach statistical significance. The overall cost of pituitary surgery in the IOUS group was \$13,365.00 vs. \$16,061.00 in the IOUS naïve group, translating into a savings of \$2,696.00 USD, even after the costs of the IOUS probe were factored in.

Figure 1



The bayoneted sterile UST-5311 -TIP ultrasound transducer is demonstrated in conjunction with intraoperative neuro-navigation

Figure 2



Intraoperative intrasellar ultrasound image demonstrating a lateral view of a macroadenoma prior to resection, extending toward the cavernous sinus (red) seen using color-doppler

Conclusions

There is a demand for cost-effective, reliable and widely available intraoperative imaging during pituitary surgery. IOUS fits this profile and has a long history of use in pituitary surgery with favorable outcomes reported here and elsewhere (3)(4)(5). The use of IOUS in pituitary surgery may result in increased extent of resection, decreased OR time, and resulting associated costs.

Figure 3



Intraoperative intrasellar ultrasound used in conjunction with neuro-navigation. Sagittal images demonstrate using the ultrasound probe registered as a navigation pointer.

References

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2. Doppman JL, Ram Z, Shawker TH, Oldfield EH: Intraoperative US of the pituitary gland. Work in progress. *Radiology* 192:111-115, 1994
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4. Solheim O, Selbekk T, Lovstakken L, Tangen GA, Solberg OV, Johansen TF, et al: Intrasellar ultrasound in transsphenoidal surgery: a novel technique. *Neurosurgery* 66:173-185; discussion 185-176, 2010
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Learning Objectives

Participants should be able to
 1) describe the importance and applications of intraoperative ultrasound use
 2) discuss the benefits of IOUS, and
 3) identify appropriate clinical scenarios for IOUS use