Cost analysis of computer-aided endoscopic sinus surgery
Gibbons M D, Gunn C G, Niwas S, Sillers M J

Record Status
This is a critical abstract of an economic evaluation that meets the criteria for inclusion on NHS EED. Each abstract contains a brief summary of the methods, the results and conclusions followed by a detailed critical assessment on the reliability of the study and the conclusions drawn.

Health technology
Two techniques for functional endoscopic sinus surgery (FESS) were evaluated in patients with chronic sinusitis. One was computer-aided surgery (CAS), which uses an electromagnetic surgical navigation system (InstaTrak System; Visualization Technologies Inc.). The other was FESS operation without surgical navigation.

Type of intervention
Treatment.

Economic study type
Cost-effectiveness analysis.

Study population
The study population comprised patients undergoing FESS for medically refractory chronic rhinosinusitis. Patients with a primary diagnosis other than chronic sinusitis or nasal polyposis were excluded, as were patients who underwent a concurrent procedure by another surgeon.

Setting
The setting was an academic tertiary care referral centre. The economic study was carried out in the USA.

Dates to which data relate
The effectiveness and resource use data were gathered from September 1996 until April 1998. The price year was not reported.

Source of effectiveness data
The effectiveness data were derived from a single study.

Link between effectiveness and cost data
The costing was carried out retrospectively on the same sample as that used in the effectiveness analysis.

Study sample
A retrospective power calculation was carried. This demonstrated that the study was underpowered to detect significant differences in the chosen outcome. The sample included consecutive patients who fulfilled the inclusion criteria and underwent FESS by the same surgeon. In total, 203 patients were included. Of these, 102 underwent FESS without CAS and 101 underwent FESS with CAS. Almost two-thirds of the sample underwent revision procedures, with the preceding operations being carried out by other surgeons. No details of the excluded patients were reported.
**Study design**
This was a single-centre (single surgeon), retrospective, comparative study with historical control. Follow-up was for 1 to 4 years. The loss to follow-up was not reported.

**Analysis of effectiveness**
The primary health outcomes were not specifically stated, but included complementary procedures performed (e.g. septoplasty, turbinate procedure), supplementary procedures, and percentage revision surgery and complications. No specific comparisons of the patients’ baseline characteristics were reported.

**Effectiveness results**
A higher proportion of patients in the non-CAS group (31 of 102) underwent a complementary procedure compared with CAS patients (25 of 101), (p=0.37), although the difference was not statistically significant. Similarly, a higher proportion of non-CAS patients (17 of 102) than CAS patients (10 of 101) underwent a supplementary procedure, (p=0.16), and again the difference was not statistically significant.

The mean number of sinuses dissected was 5.5 with CAS and 4.8 when CAS was not used, (p=0.13).

The results were similar when stratification was carried out. Stratification was conducted by splitting the operations performed according to three levels of technical difficulty.

There were no minor or major complications in the whole sample.

**Clinical conclusions**
The authors concluded that CAS is a safe technology as there were no complications in any group. There were no statistically significant differences in complementary or supplementary procedures, or in percentage revision surgery.

**Measure of benefits used in the economic analysis**
No summary measure of benefit was used in the analysis. In effect, a cost-consequences analysis was performed.

**Direct costs**
The authors provided little information on the costing methodology. They reported that cost calculations were based on actual operative time, and current rates were based on procedure length. The costs of CAS included specific costs (CAS system, disposables) and specific charges (CT reformatting, professional fee and shared resource fee). Discounting was not carried out, which was appropriate given the short time horizon of the study. The source of the costs was the authors' setting. The price year was not reported.

**Statistical analysis of costs**
The costs were treated stochastically. A Wilcoxon rank sum two-sample test was used to compare the median values of continuous variables.

**Indirect Costs**
This cost category was not considered.

**Currency**
US dollars ($).
Sensitivity analysis
No sensitivity analysis was performed.

Estimated benefits used in the economic analysis
See the 'Effectiveness Results' section.

Cost results
The total intervention costs in the two groups were not reported. Only cost-differences were shown.

CAS was 2.64% more expensive, and the difference was statistically significant, \((p=0.01)\).

The CAS group had a mean extra cost that was $78.50 higher than the non-CAS group, and a median extra cost that was $188 higher.

When stratified by level of complexity of surgery, the CAS group was still more costly, although the differences were not statistically significant:

- Level 1 surgery (5 CAS patients and 16 non-CAS patients), the mean additional cost of CAS was $111.5 and the median additional cost was $685, \((p=0.37)\);
- Level 2 surgery (34 CAS patients and 44 non-CAS patients), the mean additional cost of CAS was $79.6 and the median additional cost was $685, \((p=0.10)\);
- Level surgery (62 CAS patients and 42 non-CAS patients), the mean additional cost of CAS was $17.7 and the median additional cost was $188, \((p=0.26)\).

Synthesis of costs and benefits
The costs and benefits were not combined.

Authors' conclusions
Computer-aided surgery (CAS) for performing functional endoscopic sinus surgery (FESS) did not provide quantifiable benefits over the traditional non-CAS technique, although it may provide non-quantifiable benefits such as surgeon anatomic precision and confidence, in addition to being a teaching tool. The major difference between the two groups was the increased cost of CAS. This should be factored into the endoscopic surgeon's decision to use surgical navigation.

CRD COMMENTARY - Selection of comparators
Although no explicit justification for the comparator was given, it would appear to represent prior current practice in the authors' setting. You should decide if the comparator represents current practice in your setting.

Validity of estimate of measure of effectiveness
The analysis was based on a retrospective, single-centre (single surgeon) comparative study with historical control. This is not an optimal design for the comparison of therapeutic strategies. The fact that the same surgeon performed all the operations makes the generalisability of the results more problematic. Most of the sample had undergone a sinus operation, so it is less generalisable than first FESS. No analysis to adjust for potential confounding factors was performed, other than stratification by surgical complexity. The authors did not report whether the outcome assessment was blind, which would have helped to diminish information bias. Sample baseline characteristics were neither compared nor adjusted for, and this could have influenced the results. Given these limitations, the internal validity of the study is likely to be low.
Validity of estimate of measure of benefit
The authors did not derive a summary measure of health benefit. The reader is referred to the comments in the "Validity of estimate of measure of effectiveness" field (above).

Validity of estimate of costs
Overall, the reporting of the costing was very poor. The perspective was not reported, the methodology was reported in insufficient detail, and the unit costs and the resource quantities were not reported separately. These facts will reduce the potential generalisability. Resource use and sources were taken from the authors' setting. Although no statistical analysis of the quantities was performed (except for duration of surgery), a statistical analysis of charges was performed and the charge differences between the two techniques were reported. The price year was not reported, which will hinder any future reflation exercise.

Other issues
The authors reported that this was the first study, to their knowledge, to compare the two FESS techniques. An issue that was addressed related to the use of additional computed tomography (CT) with the headset required by 10% of the sample. The additional CT was not charged in the authors' institution but since it can be charged for, it thus makes CAS more expensive. The overall generalisability to other settings was limited by such factors.

Implications of the study
CAS is more expensive than traditional FESS, it does not compensate for inexperience of the surgeon, and it did not provide quantifiable benefits over unaided FESS. However, in the proper clinical setting, CAS is an effective tool with many intangible benefits, such as anatomic precision, increased surgical confidence and educational experience. Larger, adequately powered studies with longer follow-up are needed to provide an adequate comparison of clinical outcomes of the FESS approaches.

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