

Safety of day-case endoscopic sinus surgery in England: An observational study using an administrative dataset

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Abstract

Background: As elective surgical services recover from the COVID-19 pandemic a movement towards day-case surgery may reduce waiting lists. However, evidence is needed to show that day-case surgery is safe for many ENT operations including endoscopic sinus surgery (ESS). We aimed to investigate the safety of ESS in England. **Methods:** This was an observational, secondary analysis of administrative data. Participants were all patients in England undergoing elective ESS procedure aged [?] 17 years during for the five years from 1st April 2014 to 31st March 2019. The exposure variable was day-case or overnight stay. The primary outcome was emergency readmission within 30 days post-discharge. **Results:** Data were available for 49,223 patients operated on across 129 NHS hospital trusts. In trusts operating on more than 50 patients in the study period, rates of day-case surgery varied from 100% to 20.6%. Rates of day-case surgery increased from 64.0% in 2014/15 to 78.7% in 2018/19. Day-case patients had lower rates of 30-day emergency readmission (odds ratio 0.71, 95% confidence interval 0.62 to 0.81). For secondary outcomes measures, there was no evidence of poorer outcomes for day-case patients. Outcomes for patients operated on in trusts with [?]⁸⁰% day-case rates compared to patients operated on in trusts with <50% rates of day-case surgery were similar. **Conclusions:** ESS can safely be performed as day-case surgery at current rates. There is a potential to increase rates of day-case ESS in England, especially in departments that currently have low rates of day-case ESS.

Key points

- A total of 49,223 patients underwent endoscopic sinus surgery in England between April 2014-March 2019.
- Rates of day-case surgery varied from 100% to 20.6% across hospital trusts.
- There was no evidence of poorer outcomes for day-case patients.
- Day-case endoscopic sinus surgery appears to be safe when conducted as day-case surgery.
- Hospital trusts not already conducting day-case endoscopic sinus surgery as the default, should move to a day-case model to improve service efficiency.

ABSTRACT

Background: As elective surgical services recover from the COVID-19 pandemic a movement towards day-case surgery may reduce waiting lists. However, evidence is needed to show that day-case surgery is safe for

many ENT operations including endoscopic sinus surgery (ESS). We aimed to investigate the safety of ESS in England.

Methods: This was an observational, secondary analysis of administrative data. Participants were all patients in England undergoing elective ESS procedure aged [?] 17 years during for the five years from 1st April 2014 to 31st March 2019. The exposure variable was day-case or overnight stay. The primary outcome was emergency readmission within 30 days post-discharge.

Results: Data were available for 49,223 patients operated on across 129 NHS hospital trusts. In trusts operating on more than 50 patients in the study period, rates of day-case surgery varied from 100% to 20.6%. Rates of day-case surgery increased from 64.0% in 2014/15 to 78.7% in 2018/19. Day-case patients had lower rates of 30-day emergency readmission (odds ratio 0.71, 95% confidence interval 0.62 to 0.81). For secondary outcomes measures, there was no evidence of poorer outcomes for day-case patients. Outcomes for patients operated on in trusts with [?]80% day-case rates compared to patients operated on in trusts with <50% rates of day-case surgery were similar.

Conclusions: ESS can safely be performed as day-case surgery at current rates. There is a potential to increase rates of day-case ESS in England, especially in departments that currently have low rates of day-case ESS.

Keywords: Endoscopic sinus surgery, ear, nose and throat surgery, day-case surgery.

INTRODUCTION

As elective surgery services recover from the COVID-19 pandemic the rate of return to normal activity levels has been slower for ear, nose and throat (ENT) surgery than for other specialties in a number of countries.^{1,2} Concerns regarding spread of COVID-19 during potentially aerosol generating procedures such as endoscopic sinus surgery (ESS) may have influenced this.^{3,4} As elective ENT services now look to reduce the patient backlog, efficient working practice will be essential.

For certain groups of patients undergoing relatively low-risk procedures, day-case surgery may be part of the solution. In ENT surgery in England, prior to the COVID-19 pandemic, a number of hospital trusts, had moved to a model of day-case surgery as the default for low risk patients and low complexity procedures, including ESS.⁵

In England, The Getting It Right First Time (GIRFT) programme has a remit to reduce unwarranted variation in clinical practice where this impacts negatively on patient outcomes or service efficiency. Variation in rates of day-case surgery is an area of particular interest.^{6,7} Key barriers to increasing day-case rates identified by the GIRFT ENT national report were a cultural reluctance to change practice, a lack of day-case infrastructure, a concern that outcomes would be compromised and a sense that their day-case rates were already 'optimal' for their patient population.⁵

The aim of this study was to investigate the safety of day-case ESS within the National health Service (NHS) in England using a national administrative dataset.

METHODS

Study design

This was a retrospective analysis of administrative data from the UK Hospital Episode Statistics (HES) database. The HES database is collected by NHS Digital and included data for all NHS hospital activity in England. Reporting follows the recommendations of the format of the Strengthening of Reporting of Observational studies in Epidemiology (STROBE) guidelines.

Ethics

The presentation of data follows current NHS digital guidance for use of HES data for research purposes.⁸ Consent from individuals involved in this study was not required for analysis of this administrative dataset.

Data extraction

Setting

All NHS hospitals in England are run by trusts. Each trust covers a geographically defined catchment area of varying physical size and population. A single trust typically runs between one and four large secondary or tertiary care hospitals.

Time period

1st April 2014 to 31st March 2019 for the index procedure with follow up of all patients for one year post-surgery.

Inclusion and exclusion criteria for index procedure

We identified ESS using the Office of Populations Censuses and Surveys Classification of Interventions and Procedures version 4 (OPCS-4) codes: E081, E132, E133, E142, E143 or E148 were used in the first position in the procedural record together with the code Y761 (for functional ESS) anywhere in the procedural record. Descriptions of the definitions of these codes are given in **Supplementary material Table S1**. Patients were only included if the clinical specialty listed was ENT.

Patients were also excluded where:

1. The procedure was non-elective
2. The patient was aged <17 years.
3. Patients with a diagnosis of any of the following conditions anywhere in the diagnostic record for the index admission: malignant neoplasm, vasculitis, granulomatosis intracranial and intraspinal abscess and granuloma, granuloma and granuloma-like lesions of oral mucosa, cystic fibrosis, diseases of bronchus and cerebrospinal fluid leak without diagnosis of sinusitis or nasal polyp. Patients undergoing trans-sphenoidal pituitary surgery were also excluded. The OPCS-4 and International Statistical Classification of Diseases and Related Health Problems, tenth revision (ICD-10) codes used to define these procedures are given in **Supplementary material Table S1**.

Patients with malignant neoplasm and with the other conditions described would not routinely be considered for day-case surgery, although some are likely to be suitable for, and undergo day-case surgery.

To ensure all datapoints were independent of one another at a patient level, only the chronologically first recorded index procedure for anyone who had more than one procedure during the study period was included in the dataset. The data extraction process is summarised in **Supplementary material Figure S1**.

Primary outcome

Emergency hospital readmission within 30 days of discharge. This outcome was chosen to reflect the need for an early readmission related to a complication of surgery.

Secondary outcome

1. Repeat ESS in any subsequent admission within 180 days of discharge from the index procedure. The same OPCS-4 codes listed above for ESS were used to define repeat surgery. This follow-up period was chosen to allow sufficient time for complications of index surgery to arise, but to avoid cases of planned repeat surgery.
2. Mortality at one year post-discharge. Mortality data were taken from the UK Office for National Statistics (ONS).
3. Likely complications of surgery identified during emergency admission within 30 days post-discharge. These complications were defined within five broad categories: haemorrhage, orbital injury, cerebrospinal fluid leak, meningitis, other post-procedural complication. The ICD-10 codes used to define these complications are given in **Supplementary material Table S1**.
4. Haemorrhage was the most common recorded complication and was also considered separately.

Exposure variables

Primary exposure variable: Day-case or overnight stay. Day-case was defined as any procedure where the admission day and discharge day were the same.

Secondary exposure variable: In secondary analysis the exposure variable was defined at a trust level; trusts operating on $\geq 80\%$ of patients as day-case and trusts operating on $< 50\%$ of patients as day-case were compared. Eighty percent was chosen to reflect trusts where day-case surgery appeared to be the default and 50% was chosen to reflect trusts where surgery with overnight stay was dominant. This analysis was conducted to minimise bias, when considering the data at a patient level due to patients with more severe illness (and so potentially poorer outcomes) being more likely to stay in overnight. For this analysis, trusts performing fewer than 50 procedures over the study period (average of ten per financial year) were excluded.

Covariates

1. Age in years
2. Sex
3. Financial year of admission
4. Hospital Frailty Risk Score (HFRS)⁹
5. Complex ESS: Complex surgery was defined using any occurrence of any of the OPCS-4 codes E143, E147, E148, E151, E152 (see **Supplementary material Table S1** for descriptions).
6. Diagnosis during index admission of obesity (ICD-10 code: E66-)
7. Diagnosis of any of the 17 conditions that make up the Charlson comorbidity index¹⁰
8. Likely complications of surgery identified during the index admission. Complications were defined as described above for the outcome measures. This covariate was chosen in recognition of the fact that a complication identified during the index procedure would, in many cases, preclude same-day discharge and be associated with poorer post-discharge outcomes.

Data management and statistical analyses

Data were analysed using standard statistical software: Microsoft Excel (Microsoft Corp, Redmond, WA, USA), Stata (Stata Corp LLC, College Station, TX, USA) and Alteryx (Alteryx Inc, Irvine, CA, USA).

Age data were broadly normally distributed on visual inspection and summarised using the mean and standard deviation. All other data were categorical and were summarised using frequency and percentage. Multilevel (hierarchical) logistic regression models were constructed. All variables were treated as categorical in model building except age, which was modelled as a continuous variable using restricted cubic splines; knots (at the 10th, 50th and 90th percentile) were found to give optimal model fit for the primary outcome based on Akaike's Information Criterion.¹¹ Adjusted outcomes were calculated based on fixed-effects within a conditional framework. Confidence intervals (CIs) were used to draw inference, with a 95% CI for an odds ratio (OR) not including the value 1 taken to indicate significance.

RESULTS

The extraction process identified 49,223 ESS procedures during the study period. The procedures were performed across 129 hospital trusts. Day-case surgery was conducted for 35,494 (72.1%) patients. The characteristics and outcomes for patients seen as day-case and with overnight stay are summarised in **Table 1**. Patients with an overnight stay were on average three years older than day-case patients and more likely to have some level of frailty. Outcomes tended to be slightly poorer for overnight stay patients, most notably for complications (including haemorrhage) recorded during the index admission. Such complications are likely to have necessitated overnight stay in many cases. Although the one-year mortality rate was higher for patients with an overnight stay, this partly reflects the older age structure of the population. Mortality rates were low.

Of the 121 trusts that conducted more than 50 procedures across the five-year study period, 42 trusts (14,186

patients) performed [?]80% of procedures as day-case and 15 trusts (4,634 patients) performed <50% of procedures as day-case. In these 121 trusts, the highest rate of day-case surgery was 100% in three trusts (561 patients) and the lowest rate was 20.6% (n = 170 patients) in one trust. The distribution of day-case rates for each trust is summarised as a funnel plot in **Figure 1**.

There was a substantial increase in the proportion of procedures conducted as day-case across the study period, from 64.0% in financial year 2014/15 to 78.7 % in financial year 2018/19. Despite this increase in the overall rate of day-case surgery, in financial year 2018/19, seven trusts still performed fewer than 50% of ESS procedures as day-case. The proportion of patients seen as day-case and their outcomes are shown in **Table 2**. Patient outcomes were generally stable across the five-year period, with no clear trend.

The results of the multilevel, multivariable models comparing outcomes for day-case and overnight stay patients are presented in **Table 3**. The odds of poorer outcomes were generally lower for day-case patients after adjusting for covariates and in the case of 30-day emergency readmission, one-year return for ENT surgery and 30-day complications significant. The results of the analysis comparing trusts with high and low rates of day-case surgery are presented in **Table 4**. There was no significant difference in outcomes between high and low day-case rate trusts.

DISCUSSION

Day-case ESS activity in England has risen substantially over the last 20 years with a greater than four-fold increase in day-case rates; from 15.5% in 2000-01¹² to nearly 80% in 2018-19. We provide evidence that day-case ESS is safe. There was no evidence that outcomes were better for patients with overnight stay. Generally better outcomes for patients undergoing day-case surgery are likely to be due, in part, to confounding factors not fully adjusted for through modelling, most obviously disease severity. Our comparison of trusts with high and low rates of day-case surgery attempts to overcome this residual confounding, since presentation is unlikely to vary between the two groups of trusts in a way that would substantially bias our findings. In this analysis there was no significant difference between the two groups. It is also interesting that, despite a substantial increase in the proportion of patients undergoing day-case ESS over the five-year, outcomes were relatively stable over time.

Most previous studies on the safety of day-case ESS are relatively small. A study of outcomes from 909 rhinology procedures published in 2021 reported no difference in readmission rate between outpatient (day-case) and inpatient groups.¹³ The authors noted higher complication rates in those with overnight stay, highlighting differences in patient selection criteria for day-case surgery.¹³ Nevertheless, the conversion rate from day-case to overnight stay was less than 5%. A single surgeon study of 181 patients (both day-case and overnight stay) from New Zealand concluded that day-case sinonasal surgery was safe and acceptable to patients.¹⁴ An earlier case note review involving 105 day-case ESS patients drew similar conclusions and suggested important factors in successful implementation of day-case ESS were careful patient selection and dedicated day-case infrastructure.¹⁵ A French study focussing on patient reported outcomes for endoscopic ethmoidectomy reported no readmission and no major complications in their series of 74 patients. SNOT-22 scores decreased on average by 56% post-operatively, demonstrating good surgical outcomes in day-case ESS.¹⁶

One of the reasons often cited for the need to have an overnight observation following ESS, other than patient co-morbidities, is the risk of post-operative haemorrhage.¹² However, advances in ESS techniques have led to reduced morbidity associated with the procedure. Furthermore, the utilisation of topical vasoconstrictor agents, antifibrinolytic medications and hypotensive anaesthetic practice have contributed to reduced intra-operative and post-operative bleeding, supporting a day-case model.^{17,18} We found relatively low rates of haemorrhage during the index procedure (0.5% (day-case) and 4.3% (overnight stay)) compared to an earlier large prospective cohort study of ESS in England and Wales that reported excessive perioperative bleeding rates of 5% and post-operative haemorrhage rates of 1%.¹⁹ Some of these differences may be due to differences in data collection (coded events vs surgeon reported). The indication for overnight stay for many patients is likely to have been excessive perioperative or immediate post-operative haemorrhage, explaining the higher

haemorrhage rate in this group. Recent increases in the use of absorbable packing also enables patients to be discharged with nasal packing still in situ if post-operative minor haemorrhage is a concern.^{20,21}

There remains substantial variation between NHS hospital trusts in England in rates of day-case ESS. In the last full financial year prior to the COVID-19 pandemic a number of trusts still had overnight stay for the majority of patients. The barriers to day-case ESS can be cultural as well as practical. Surgical preference and trust policy can hinder attempts to create an effective day surgery pathway. Careful theatre management that takes into account operation timing and case-mix will help optimise day-case surgery potential.¹³ The proximity of the patient's home address need not be an absolute contraindication to day-case surgery. In France, non-medical accommodation has been offered to patients travelling a long distance for their surgery.¹³ Such provision is substantially less costly than a hospital bed. Day-case surgery can support more cost-effective and resource-efficient provision of surgical services by preventing unnecessary bed occupation¹⁴ and reducing risks of hospital acquired infection and deconditioning.²²

A further consideration that will impact the surgical management of sinonasal disease is the emergence of balloon sinuplasty which can be performed under local anaesthetic, and therefore as a day-case or out-patient office procedure.²³ Complication risks are similar to those of conventional ESS.²⁴ Although not indicated for all patients, identifying patients that would benefit from this procedure may help reduce ESS waiting lists.²⁵

The ability to track patients across hospitals in England and the comprehensiveness of the HES database are strengths of our study. However, the lack of data relating to some aspects of clinical presentation limited the extent to which we could adjust for this. Some data entry inconsistencies between trusts have been noted, mostly with regard to differences in clinical coding practice across trusts.⁵ However, coding for ESS is relatively uncomplicated and so may be less prone to such errors. Data on patient quality of life and other patient reported outcomes were not available and would have added markedly to the depth of our findings.

Conclusions

Our study provides evidence that outcomes for day-case and overnight stay ESS are similar. Although not indicated for all patients, day-case surgery will be appropriate for large numbers of patients and should be utilised where possible to improve patient experience and hospital productivity.

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Figure legends

Figure 1: Variation in the day-case rate by hospital trust

Note: The inner control limits represent two standard errors and the outer control limits three standard errors from the England average. This funnel plot demonstrates that there is wide variation in day-case rate ESS, especially in trusts that performed less than 400 ESS procedures over the 5 year time period.

Table 1: Profile of all patients undergoing endoscopic sinus surgery

Variable	Day-case (n = 35,494)	Over
Mean age in years (standard deviation)	49.7 (14.845)	52.6
Number of males (%), 3 missing values	20959 (59.1%)	8137
Hospital Frailty Risk Score		
<i>None</i>	33327 (93.9%)	1231
<i>Mild</i>	1842 (5.2%)	1082
<i>Moderate</i>	309 (0.9%)	310
<i>Severe</i>	16 (0.1%)	24
Number of patients undergoing complex ESS	7482 (21.1%)	3189
Emergency hospital readmission within 30 days of discharge	723 (2%)	428
Return for ESS within 180 days of discharge	229 (0.6%)	85
Death within one year of discharge	81 (0.2%)	63
Any complications recorded during index stay	344 (1.0%)	836
Haemorrhage recorded during index stay	164 (0.5%)	588
Orbital injury recorded during index stay	97 (0.3%)	87
Cerebrospinal fluid leak recorded during index stay	2 (0.01%)	18
Meningitis recorded during index stay	0	0
Any complications recorded on emergency readmission within 30 days of discharge	425 (1.2%)	222
Haemorrhage recorded on emergency readmission within 30 days of discharge	305 (0.9%)	153
Orbital injury recorded on emergency readmission within 30 days of discharge	30 (0.1%)	11
Cerebrospinal fluid leak recorded on emergency readmission within 30 days of discharge	1 (0.003%)	5
Meningitis recorded on emergency readmission within 30 days of discharge	3 (0.01%)	3

Table 2: Change in proportion of patients operated on as day-case and outcomes over the five-year study period

Financial year	2014/15	2015/16	2016/17
Number of patients	10105	10029	10371
Number of patients as day-case	6471 (64.0%)	6937 (69.2%)	7575 (72.9%)
Number of patients undergoing complex ESS	2291 (22.7%)	2159 (21.5%)	2252 (21.7%)
Emergency readmission within 30 days of discharge	207 (2.0%)	230 (2.3%)	259 (2.5%)
Return for ESS within 180 days of discharge	67 (0.7%)	74 (0.7%)	69 (0.7%)
Death within one year of discharge	33 (0.3%)	31 (0.3%)	35 (0.3%)
Any complications recorded during index stay	232 (2.3%)	224 (2.2%)	251 (2.4%)
Haemorrhage recorded during index stay	162 (1.6%)	160 (1.6%)	153 (1.5%)
Any complications recorded on emergency readmission within 30 days of discharge	119 (1.2%)	128 (1.3%)	140 (1.3%)
Haemorrhage recorded on emergency readmission within 30 days of discharge	90 (0.9%)	92 (0.9%)	97 (0.9%)

Table 3: Summary of multilevel, multivariable models of the relationship between day-case surgery and outcomes

Outcome	Odds ratio (95% confidence interval)
Emergency readmission within 30 days of discharge	0.71 (0.62 to 0.81)

Outcome	Odds ratio (95% confidence interval)
Return for ESS within 180 days of discharge	1.12 (0.86 to 1.46)
Death within one year of discharge	0.79 (0.55 to 1.12)
Complications recorded on emergency readmission within 30 days of discharge	0.79 (0.66 to 0.94)
Haemorrhage recorded on emergency readmission within 30 days of discharge	0.86 (0.69 to 1.05)

Note: An odds ratio less than 1 indicates that the outcome was less common for patients undergoing day-case surgery and an odds ratio greater than 1 indicates that the outcome was more common for patients undergoing day-case surgery. A 95% confidence interval which does not cross the value 1 indicates statistical significance at the 5% level.

Table 4: Summary of multilevel, multivariable models of the relationship between trusts with high and low rates of day-case surgery and outcomes

Outcome	Odds ratio (95% confidence interval)
Emergency readmission within 30 days of discharge	1.15 (0.86 to 1.53)
Return for ESS within 180 days of discharge	1.48 (0.83 to 2.66)
Death within one year of discharge	1.34 (0.72 to 2.49)
Complications recorded on emergency readmission within 30 days of discharge	1.50 (0.99 to 2.25)
Haemorrhage recorded on emergency readmission within 30 days of discharge	1.57 (0.98 to 2.52)

Note: Odds ratios refer to the odds of the outcome in trusts with a day-case rate [?] 80% relative to a trust with day-case rates < 50% (reference group). An odds ratio less than 1 indicates that the outcome was less common for high day-case rate trusts and an odds ratio greater than 1 indicates that the outcome was more common for high day-case rate trusts. A 95% confidence interval which does not cross the value 1 indicates statistical significance at the 5% level.

