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A multi-centre, prospective epidemiological surveillance study considering ophthalmic complications of functional endoscopic sinus surgery

S Burgess[1], J Foulds[2], P White[3], B Foot[4] and C MacEwen[1]

Departments of [1]Ophthalmology, [3]ENT, Ninewells Hospital and Medical School, Dundee, Scotland, [2]Department of Ophthalmology, Queen Margaret Hospital, Dunfermline, Scotland and [4]Royal College of Ophthalmologists, London, UK

Main Article

Mr S Burgess takes responsibility for the integrity of the content of the paper

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Author for correspondence:
Mr Stephen Burgess, Department of Ophthalmology, Ninewells Hospital, Dundee DD1 9SY, Scotland, UK
E-mail: stephenburgess@nhs.net

Abstract

Objectives. This prospective, epidemiological British Ophthalmological Surveillance Unit study into ophthalmic complications of functional endoscopic sinus surgery aimed to determine the minimum incidence, presenting features and management throughout the UK.

Methods. Cases of ophthalmic complications of functional endoscopic sinus surgery, between February 2016 and February 2018, were identified through the British Ophthalmological Surveillance Unit reporting card system. Reporting ophthalmic consultants were sent an initial questionnaire, followed by a second questionnaire at six months.

Results. Twenty-six cases of ophthalmic complications of functional endoscopic sinus surgery were reported. The majority (16 cases (62 per cent)) had limitations of ocular motility at presentation. The most common final diagnosis was rectus muscle (33 per cent) and nasolacrimal duct trauma (27 per cent). Using national data, this study reports a minimum incidence of ophthalmic complications of functional endoscopic sinus surgery in the UK of 0.2 per cent over two years.

Conclusion. In terms of ophthalmic complications, functional endoscopic sinus surgery is shown to be safe. Ophthalmic complications are rare, but when they do occur, they commonly result in rectus muscle trauma, often requiring surgical intervention.

Introduction

Functional endoscopic sinus surgery (FESS) is now the standard procedure used to treat a variety of nasal and sinus pathologies. It is a complex procedure carried out in close proximity to the orbit. The relationship between the paranasal sinuses and the orbits creates potential for traumatic orbital injury, with direct or indirect effects on ocular function.[1] Over the last 20 years, the number and spectrum of endonasal sinus operations has increased. The range includes partial uncinectomy, pan-sinus surgery with extended surgery of the frontal sinus (Draf type III procedure), maxillary sinus surgery (grade 3–4, medial maxillectomy, pre-lacrimal approach), and sphenoid sinus surgery.[2]

Between February 2016 and February 2018, there were 11 987 endoscopic sinus procedures carried out in the UK. Previous literature has highlighted the rarity of orbital complications following FESS. However, the orbit, globe, optic nerves, extraocular muscles and lacrimal drainage systems have all been well documented as potential sites for accidental damage during FESS.[3] Despite the high volume of completed procedures in the UK, the incidence of ophthalmic complications as a result of FESS presenting to the ophthalmic department is unknown and the UK pattern has never been determined. In light of this uncertainty, the British Ophthalmological Surveillance Unit funded and supported this study to help ascertain the incidence of ophthalmic complications of FESS within the UK. This study aimed to identify the surgical subcategories where these events occur, the common presenting features and the management of any such trauma.

Materials and methods

Ethical considerations

Multi-centred ethics approval was obtained from the National Research Ethics Service on 7 October 2014 (14/WM/1181). No identifiable patient information was collected.

Study design and participants

Patients who presented to any UK ophthalmology department with ophthalmic complications of FESS, from February 2016 to February 2018, were included in the study. New cases of ophthalmic complications of FESS were ascertained using population-based

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active surveillance through the British Ophthalmological Surveillance Unit yellow card system.[4] All consultant ophthalmologists in the UK receive the British Ophthalmological Surveillance Unit yellow card on a monthly basis. The card advertises the current studies open to recruitment. Recruitment to studies is voluntary and data collection can only occur once the consultant has returned the yellow card.

The ophthalmic complications of FESS study was placed on the yellow card in February 2016 for two years. Consultants who reported a case of FESS-related ophthalmic complications received an initial questionnaire to complete. A follow-up questionnaire was sent out six months later. These questionnaires were designed to be easy to complete whilst being minimally time consuming. The questionnaires were e-mailed to all ophthalmic consultants registered with the British Oculoplastic Surgery Society prior to the commencement of this study, so that awareness of data collection was increased and consultant satisfaction with the questionnaires was confirmed.

Results

This prospective British Ophthalmological Surveillance Unit study into the ophthalmic complications of FESS is the first in the UK. It is estimated from previous international studies that the incidence of ophthalmic complications of FESS is likely to be well under 1 per cent.[4]

Using national surgical data gathered from National Health Service (NHS) digital services, NHS National Services Scotland and the Department of Health for Northern Ireland, it was determined that there were 11 987 nasal and sinus surgery procedures carried out in the UK between 2106 and 2018. Twenty-six cases of ophthalmic complications of FESS were reported between February 2016 and February 2018 through the British Ophthalmological Surveillance Unit reporting system. This British Ophthalmological Surveillance Unit study is therefore able to provide an estimate of the minimum incidence of ophthalmic complications of FESS in the UK, which was calculated to be 0.2 per cent over two years.

Fifteen male and 11 female cases of FESS-related ophthalmic complications were reported, with a mean age of 60 years (range, 26–98 years). The distribution of these cases is shown in Figure 1. Multiple cases were reported in the Cambridgeshire, Greater London, Newcastle, Birmingham, Cardiff and Belfast areas during the period of data collection.

Of the 26 eyes reported to be affected by ophthalmic complications of FESS, 7 were left eyes and 19 were right. No bilateral cases were reported. The most common timeframe from FESS to ophthalmic referral was 1–7 days. Most referrals of ophthalmic complications of FESS (20 cases (77 per cent)) were received from ENT consultants.

The most common indication for FESS was nasal blockage (15 cases (58 per cent)). Other indications were recurrent sinus infection (four cases (15 per cent)), lesion biopsy (two cases (8 per cent)), epistaxis (one case (4 per cent)) and nasolacrimal duct blockage (two cases (8 per cent)). Two cases did not report the indication for FESS. The most frequent ophthalmic problems at presentation were diplopia and orbital haematoma. Whilst diplopia was not necessarily the initial reason for referral, 16 cases (62 per cent) were found to have motility disorder at initial presentation to ophthalmology.

At the time of initial presentation, visual acuity ranged from −0.18 logarithm of the minimum angle of resolution (logMAR) to no perception of light. Twenty-three (88 per cent) of the 26 reported cases had a visual acuity of 0.30 logMAR or better. One of the remaining three patients presented with an acuity of 0.90 logMAR and another with no perception of light. Both of these patients suffered retrobulbar haemorrhage secondary to FESS. The final case presented with hand movement only vision secondary to central retinal artery occlusion.

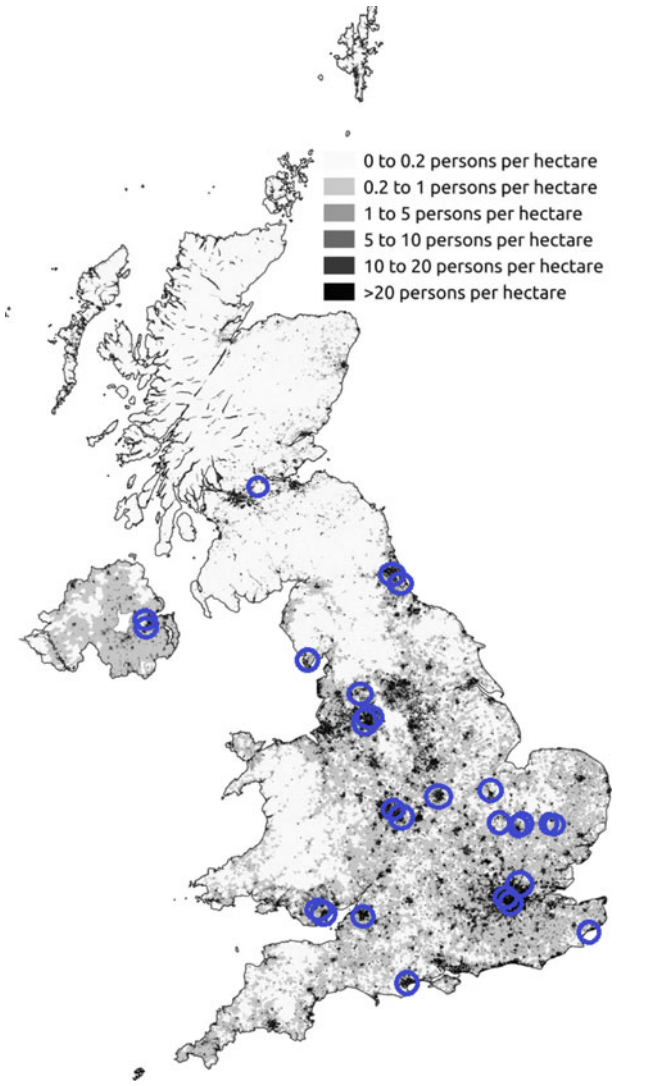


Fig. 1. Distribution of ophthalmic complications of functional endoscopic sinus surgery as reported across the UK.

Anterior segment examination of the affected eyes was reported as normal in all but three cases; in these three cases, chemosis and diffuse subconjunctival haemorrhage were noted. Posterior segment examination findings were normal in all but two cases. Disc haemorrhages were reported in one case and a central retinal artery occlusion following sphenopalatine artery embolisation was noted in the other.

Initial imaging was carried out in all but three of the cases. Computed tomography (CT) was carried out in 13 cases. Magnetic resonance imaging was carried out in seven cases following CT. Magnetic resonance imaging was the only method of imaging used in one case. Dacryoscintigraphy and dacryocystography were also undertaken in one case each. Twenty cases (77 per cent) were initially referred to and seen by departmental orthoptists, and four (5 per cent) underwent visual field testing.

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Eleven cases (42 per cent) were initially managed conservatively. This included simple observation in the majority and the use of prisms in one patient. One patient declined a proposed dacryocystorhinostomy and was therefore managed conservatively. Systemic treatments included intravenous (IV) or oral steroids, IV or oral antibiotics, and IV acetazolamide. The breakdown of these systemic treatments is shown in Figure 2; several patients were treated with multiple systemic therapies. Ten cases (38 per cent) underwent surgical intervention. These treatments are detailed in Figure 3. Of the 10 cases treated surgically, 6 (60 per cent) underwent multiple procedures. Five cases (19 per cent) were treated with topical therapy, with topical chloramphenicol being used in all five cases; topical dexamethasone was also used in one case.

The median time to follow up for all 26 reported cases of ophthalmic complications of FESS was two to four weeks. A small number of patients (three cases (12 per cent)) were discharged following initial referral, assessment and treatment. Three cases (12 per cent) were referred intra-departmentally to local motility services, and four cases (15 per cent) were referred to other specialist ophthalmic centres for further treatment.

All reporting ophthalmologists were sent a follow-up questionnaire after six months. Sixteen completed follow-up questionnaires were received. This represents 62 per cent of the original cohort of 26. All but three patients (19 per cent) were discharged during the six-month follow-up period. None of these patients had a final visual acuity of less than 0.2 logMAR. Figure 4 details the final diagnosis following complications secondary to FESS, with the most common final diagnosis being rectus muscle (33 per cent) and nasolacrimal duct trauma (27 per cent).

Only five (31 per cent) of the follow-up questionnaires reported recovery of the initial presenting symptoms. Of those patients treated conservatively, symptoms settled in only 4 (31 per cent) of 13 cases at the six-month mark. Just 2 (20 per cent) of the 10 patients treated medically had resolution of their original symptoms at follow up. The surgically treated patients (eight cases (50 per cent)) fared better, with five (63 per cent) reporting resolution of their symptoms at six months.

For patients with ongoing symptoms (10 cases), three (30 per cent) were started on lubricants. Two patients (20 per cent) were treated with long-term oral antibiotics and one (10 per cent) was treated with long-term oral steroids. Within the follow-up cohort, six patients (38 per cent) required multiple surgical interventions. Two of those (30 per cent) required further dacryocystorhinostomy and four (60 per cent) required secondary squint surgery. Eight (50 per cent) of the 16 cases followed up underwent secondary ophthalmic intervention. Of this cohort, four cases (50 per cent) did not improve despite treatment.

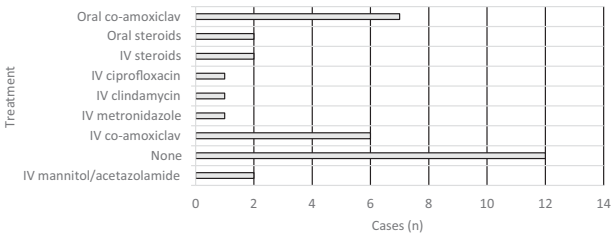


Fig. 2. Systemic treatments. IV = intravenous

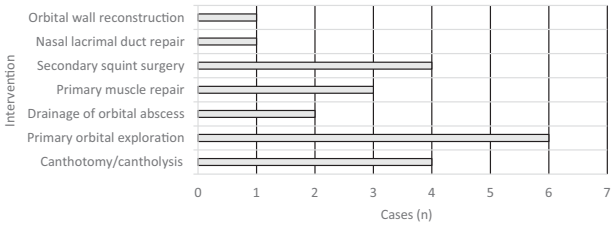


Fig. 3. Surgical interventions.

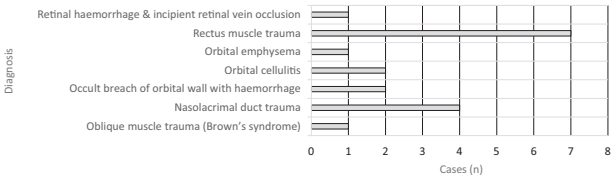


Fig. 4. Final diagnosis.

Discussion

Synopsis of key findings

This study indicates the distribution of ophthalmic complications of FESS across the UK. This distribution represents the reporting hospitals. As expected, the distribution reflects the major ophthalmic and population centres in the UK. Only one case was reported in Scotland, even though it has a population of five million. Given that 634 cases of FESS were carried out across the reporting period in Scotland, this gives an incidence of just 0.1 per cent over two years. Two cases of ophthalmic complications of FESS were reported in Northern Ireland, which has a population of 1.9 million. A total of 637 cases of FESS were completed in Northern Ireland during the reporting period. This equates to an incidence of 0.3 per cent.

- This prospective study is the first to determine the minimum incidence of ophthalmic complications secondary to functional endoscopic sinus surgery (FESS) in the UK
- The minimum UK incidence of ophthalmic complications secondary to FESS was 0.2 per cent over two years
- The most common complication reported was unilateral rectus muscle trauma resulting in diplopia
- The surgical approach to the right nasal cavity and paranasal sinuses may be compromised by the surgeon's position
- The surgeon's position may be increasing the risk of right-sided orbital complications
- One-third of patients require multiple surgical corrective procedures following orbital injury secondary to FESS

The most common final diagnosis for patients with ophthalmic complications of FESS was rectus muscle trauma. This correlates well with the most common presenting symptom of diplopia. Nasolacrimal duct injury followed as the next most common final diagnosis. The number of cases diagnosed with nasolacrimal injury in the follow-up cohort increased relative to the numbers at initial presentation. We suggest this may be because occult nasolacrimal injury was only formally diagnosed following the resolution of orbital haematoma or because symptomatic epiphora was not reported until follow up.

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Systemic antibiotics were used in 16 patients. All but three of these patients received co-amoxiclav. Co-amoxiclav is a broad-spectrum antibiotic with anaerobic cover. Direct communication between the nasal mucosa and orbit can occur during the orbital FESS injury, providing an uncompromised route for the transfer of anaerobic bacteria. Co-amoxiclav is therefore a reasonable choice of first-line agent in the prophylaxis of potential orbital cellulitis.

Over one-third of patients with ongoing symptoms at the six-month period required multiple surgical procedures. This highlights the potential of ophthalmic complications of FESS to cause complex orbital, rectus muscle or nasolacrimal duct injury requiring multiple corrective procedures. The literature provides evidence of the potential of FESS to cause complex orbital trauma.[3] We can therefore conclude that whilst most orbital trauma secondary to ophthalmic complications of FESS is minor, the risk of serious injury necessitates thorough investigation and appropriate onward referral as necessary.

Study strengths

Reported complications were ascertained via a well-established surveillance methodology shown to be effective[5] and applicable to UK healthcare.[4] Previous studies identifying cases through the British Ophthalmological Surveillance Unit system have indicated that ascertainment rates usually lie between 65 per cent and 95 per cent.[4] The British Ophthalmological Surveillance Unit reporting scheme is dependent on voluntary reporting, and there is evidence of good compliance from reporting ophthalmologists.[4]

Study limitations

The six-month follow-up questionnaire received a 62 per cent response. This is not an uncommon dropout rate for questionnaire-based prospective studies. The power of this British Ophthalmological Surveillance Unit study would be greater if this rate had been higher.

The causes of regional incidence variation and incidence underestimation are multifactorial. However, it is probable that there is a degree of under-reporting. The largest number of cases was reported in the Cambridgeshire area. This could be a result of the large number of tertiary orbital centres within this region; it could also represent a propensity of consultants in this area to report cases. This therefore highlights a potential for bias in this study design.

Comparisons with other studies

By six months, only five patients (19 per cent) with reported ophthalmic complications of FESS had not been discharged. All of these patients had good visual acuity (0.2 logMAR or better). Other studies have reported significant and long-term loss of visual acuity following ophthalmic complications of FESS, but this is fortunately rare.[6–8] The current study showed that, in the UK, vision loss secondary to ophthalmic complications of FESS is similarly rare.

This British Ophthalmological Surveillance Unit study shows that ophthalmic complications of FESS are a rare condition in the UK (0.2 per cent over two years). In comparison to other published papers, this rate is a little lower. They estimate an incidence between 0.5 and 5 per cent.[9,10] This may suggest a weakness in the overall completeness of the British Ophthalmological Surveillance Unit reporting process. It may also reflect the increasing safety of FESS in the UK – a result of increased teaching and improvements in instrument technology.[1,11]

The presenting symptoms were primarily diplopia and orbital haematoma. This is in keeping with the findings of other studies, and suggests that orbital haematoma, with or without diplopia, is the hallmark of ophthalmic complications following FESS.[12,13] Diplopia following FESS is an indication for urgent referral to an ophthalmic centre for further investigation.

Clinical applicability

It is important to note that almost three times more right-sided complications were reported than left (17 *vs* 6, respectively). One possible explanation for this concerns the position of the operating surgeon. Most surgeons are right-handed and will therefore stand on the patient's right side when operating. Consequently, the surgeon's approach to the left nasal cavity and paranasal sinuses is relatively easy. The approach to the right nasal cavity and paranasal sinuses is ergonomically compromised for the right-handed surgeon, who, by convention, continues to stand on the patient's right side, and must twist round to get the correct trajectory of the endoscope and other instruments. This finding has clinical implications, as the right orbit may be at increased risk with current convention.

In the UK, ophthalmic complications of FESS are rare. This study has shown that such complications are generally well managed, with most patients being discharged within six months. There is potential for ophthalmic complications of FESS to cause loss of vision and complex orbital injury, often requiring multiple surgical procedures. Every effort should therefore be made to further minimise these complications. The management of ophthalmic complications of FESS could therefore be improved by quick onward referral to an orbital centre with the expertise to fully investigate and treat these cases.

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Competing interests. None declared

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