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A Multi-centre, Prospective Epidemiological Surveillance Study Considering Ophthalmic Complications of Endoscopic Sinus Surgery

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Abstract

Background: This prospective, epidemiological British Ophthalmological Surveillance Unit (BOSU) study into ophthalmic complications of endoscopic sinus surgery (OCESS) determines the minimum incidence, presenting features and management throughout the UK.

Methodology/Principal: Cases of OCESS were identified through the BOSU reporting card system between February 2016 February 2018. Reporting ophthalmic consultants were sent an initial questionnaire which was followed by a second questionnaire at 6 months.

Results: Twenty-six cases of OCESS were reported. The majority (16 cases (62%)) had limitations of ocular motility at presentation. The most common final diagnosis was rectus muscle (33%) and naso-lacrimal duct trauma (27%). Using national data this study reports a minimum incidence of OCESS in the UK is 0.2% over two years.

Conclusions: In terms of ophthalmic complications, 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.

Keywords

Surgical Endoscopy, Epidemiology, Nasal Sinuses, Complications, Eye Injury

Text

INTRODUCTION

Endoscopic sinus surgery (ESS) 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 effect 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), maxillary sinus, (grade 3–4, medial maxillectomy, prelacrimal approach) and sphenoid sinus surgery[(2)].

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

MATERIALS AND METHODS

Ethical Considerations

Multi-centred ethics approval was obtained from the National Research Ethics Service (NRES) on 06/10/2014 (14/WM/1181). No patient identifiable information was collected.

Study Design and Participants

Patients who presented to any ophthalmology department in the United Kingdom (UK) with OCESS from Feb 2016 to Feb 2018 were included in the study. New cases of OCESS were ascertained using population based active surveillance through the BOSU yellow card system[4]. All consultant ophthalmologists in the UK receive the BOSU 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 OCESS study was placed on the yellow card in Feb 2016 for 2 years. Consultants who reported a case of OCESS received an initial questionnaire to complete. A follow-up questionnaire was sent out 6 months later. These questionnaires were designed to be easy to complete whilst being minimally time consuming. The questionnaires were emailed 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 BOSU study into OCESS is the first in the United Kingdom. It is estimated from previous international studies that the incidence of OCESS is likely to be well under 1%[4]. Using national surgical data gathered from NHS digital services, NHS national services Scotland and The Department of Health for Northern Ireland there were 11,987 nasal and sinus surgery procedures carried out in the UK between 2106 and 2018. 26 cases of OCESS were reported between February 2016 and February 2018 through the BOSU reporting system. This BOSU study is therefore able to provide an estimate of the minimum incidence of OCESS in the UK, which is calculated to be 0.2% over two years.

15 male and 11 female cases were reported with a mean age of 60 (range 26-98). The distribution of these cases is shown in figure I. Multiple cases were reported in the Cambridgeshire, Greater London, Newcastle, Cardiff, and Birmingham areas during the period of data collection. One case was reported in Scotland, 2 cases in Northern Ireland and 2 in Wales.

Of the 26 eyes reported, there were 7 left eyes and 19 right affected by OCESS. No bilateral cases were reported. The most common timeframe from ESS to ophthalmic referral was 1-7 days. Most referrals of OCESS (20 cases (77%)) were received from Ear, Nose and Throat consultants.

The most common indication for ESS was nasal blockage (15 cases (58%)). Other indications were recurrent sinus infection (4 cases (15%)), biopsy of lesion (2 cases (8%)), epistaxis (1 case (4%)) and nasolacrimal duct blockage (2 cases (8%)). Two cases did not report the indication for ESS. The most frequent ophthalmic problems at presentation were diplopia and orbital haematoma. A full breakdown of the nature of the presenting ophthalmic complaint is depicted in figure II. Whilst diplopia was not necessarily the initial reason for referral, 16 cases (62%) were found to have motility disorder at initial presentation to ophthalmology.

At the time of initial presentation, the visual acuity ranged from -0.18 logmar to no perception of light. Twenty three (88%) 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 ESS. The final case presented with hand movements vision secondary to central retinal artery occlusion.

Anterior segment examination of affected eyes was reported as normal in all but 3 cases, in which chemosis and diffuse subconjunctival haemorrhage were noted. Posterior segment examination was normal in all but 2 cases. Disc haemorrhages were reported in one and a central retinal artery occlusion following sphenopalatine artery embolisation was noted in the other.

Initial imaging was carried out in all but 3 of the cases. Computer Tomography (CT) was carried out in 13 cases. Magnetic Resonance Imaging (MRI) was carried out in 7 cases

following CT. MRI was the only method of imaging used in 1 case. Dacryoscintography and Dacryocystography were also undertaken in 1 case each. 20 (77%) cases were initially referred to and seen by departmental orthoptists, and 4 (5%) underwent visual field testing.

Eleven (42%) cases 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)/oral steroids, IV/oral antibiotics and IV acetazolamide. The breakdown of these systemic treatments is shown in figure III, several patients were treated with multiple systemic therapies. Ten (38%) of cases underwent surgical intervention. These treatments are detailed in figure IV. Of the 10 cases treated surgically, 6 (60%) underwent multiple procedures. Five (19%) cases were treated with topical therapy, topical chloramphenicol being used in all 5 cases, plus in the case of one patient, topical dexamethasone was also used.

The median time to follow-up for all 26 reported cases of OCESS was 2-4 weeks. A small number of patients (3 (12%)) were discharged following initial referral and assessment/treatment. Three (12%) cases were referred intra-departmentally to local motility services and 4 (15%) cases were referred to other specialist ophthalmic centres for further treatment.

Following 6 months, all reporting ophthalmologists were sent a follow-up questionnaire. Sixteen follow-up questionnaires were received. This is 62% of the original cohort of 26. All

but 3 (19%) patients were discharged during the 6-month follow-up period. None of these cases had a final visual acuity of less than 0.2 logmar. Figure 5 details the final diagnosis following complications secondary to ESS.

Only 5 (31%) of the follow-up questionnaires reported recovery of initial presenting symptoms. Of those patients treated conservatively, symptoms settled in only 4 (31%) of 13 cases at the 6-month mark. Just 2 (20%) of the 10 patients treated medically had resolution of their original symptoms at follow-up. The surgically treated patients (8 cases (50%)) fared better with 5 (63%) reporting resolution of their symptoms at 6 months.

For patients with ongoing symptoms (10 cases), three (30%) were started on lubricants. Two (20%) were treated with long-term oral antibiotics and one (10%) was treated with long-term oral steroids. Within the follow-up cohort, 6 (38%) patients required multiple surgical interventions. Two of those (30%) required further dacryocystorhinostomy and 4 (60%) required secondary squint surgery. Eight (50%) of the 16 cases followed-up underwent secondary ophthalmic intervention. Of this cohort, 4 (50%) of the cases did not improve despite treatment.

DISCUSSION

Synopsis of key findings

This study has demonstrated the distribution of OCESS across the UK. This distribution represents the reporting hospitals. As expected, the distribution reflects the major ophthalmic and population centers in the UK. Only 1 case was reported in Scotland even though it has a

population of 5 million. Given that 634 cases of ESS were carried out across the reporting period in Scotland this gives an incidence of just 0.1% over two years. 2 cases of OCESS were reported in Northern Ireland which has a population of 1.9 million. 637 cases of ESS were completed in Northern Ireland during the reporting period. This equates to an incidence of 0.3%.

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

Systemic antibiotics were used in 16 patients. All but 3 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 ESS 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 on-going symptoms at the 6-month period, required multiple surgical procedures. This highlights the potential of OCESS to cause complex orbital, rectus

muscle or naso-lacrimal duct injury requiring multiple corrective procedures. The literature provides evidence of the potential of ESS to cause complex orbital trauma[3]. We can therefore conclude that whilst most orbital trauma secondary to OCESS is minor, the risk of serious injury necessitates thorough investigation and appropriate onward referral as necessary.

Strengths of this Study

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 BOSU system have indicated that ascertainment rates usually lie between 65% and 95%[4]. The BOSU reporting scheme is dependent on voluntary reporting and there is evidence of good compliance from reporting ophthalmologists[4].

Study Limitations

The 6-month follow-up questionnaire received a 62% response. This is not an uncommon dropout rate for questionnaire-based prospective studies. The power of this BOSU 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 were reported in the Cambrideshire area. This could be due to 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 6 months only 5 (19%) of the reported cases were not discharged. All of these patients had good visual acuity (0.2 logmar or better). Other studies have shown that significant and long-term loss of visual acuity following OCESS has been reported but it is fortunately rare[6,7,8]. This study shows that in the UK vision loss secondary to OCESS is similarly rare.

This BOSU study has shown OCESS to be a rare condition in the UK (0.2% over two years). In comparison to other published papers this is a little lower. They estimate an incidence between 0.5 – 5%[9,10]. This may suggest a weakness in the overall completeness of the BOSU reporting process. It may also reflect increasing safety of ESS in the UK – reflecting 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 ESS[12,13]. Diplopia following ESS 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 verses 6 respectively). We propose that an explanation for this may be found in 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 and must twist round to get the correct trajectory of the endoscope/instruments. This finding has clinical implications as the right orbit may be at increased risk with current convention.

In the UK, OCESS is rare. This study has shown that such complications are generally well managed with most patients being discharged within 6 months. There is potential for OCESS 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 OCESS could therefore be improved by quick onward referral to an orbital centre with the expertise to fully investigate and treat these cases.

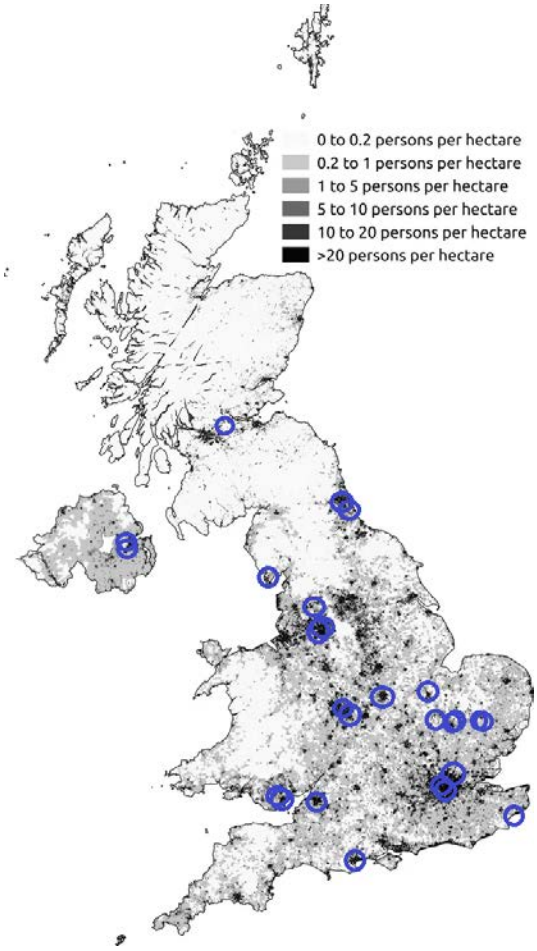

Fig.1
Distribution of OCESS as reported across the UK

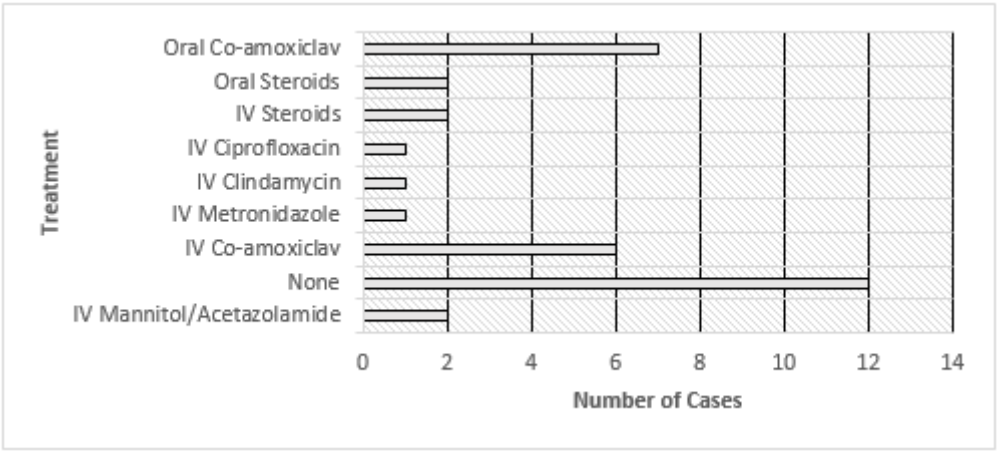

Fig.2
Systemic Treatments

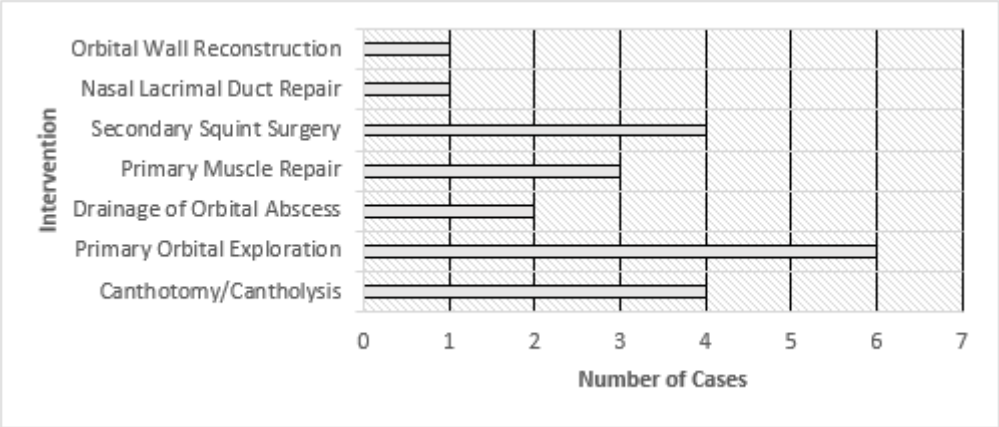

Fig.3
Surgical Interventions

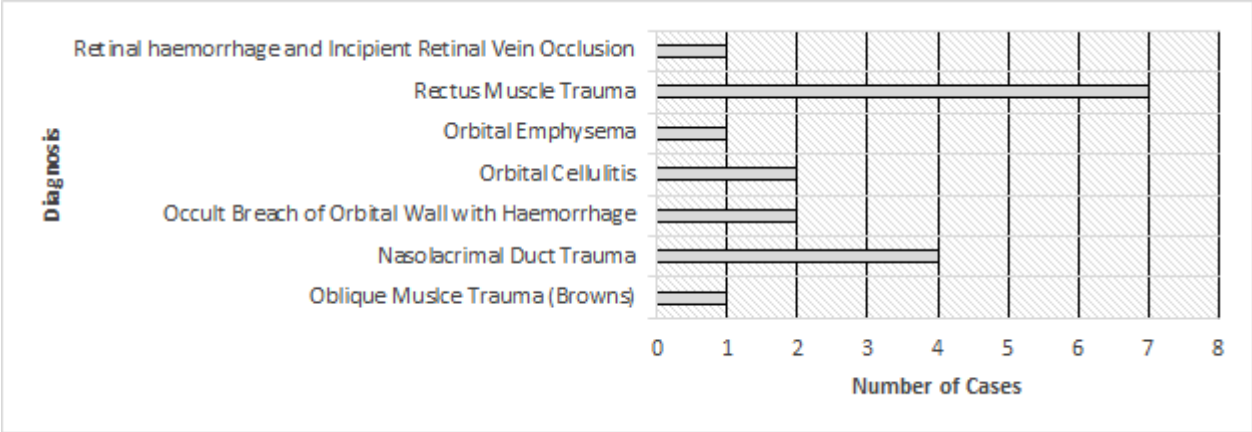

Fig.4
Final Diagnosis

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Conflict of Interest

None of the authors have any conflicts of interest to declare.

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Bullet Point Summary

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