Original Article

Radiological reporting of CT paranasal sinuses: CLOSE to the mark? The Australian otolaryngologists' perspective

Brandon Cadd[1,2]^, Hershil Khatri[1], Samuel Mohr[1], Johannes C. Oosthuizen[1]

[1]Department of Otolaryngology, Ipswich General Hospital, Ipswich, Queensland, Australia; [2]Department of Otolaryngology, Head and Neck Surgery, Royal Brisbane Hospital, Queensland, Australia

Contributions: (I) Conception and design: JC Oosthuizen, B Cadd; (II) Administrative support: S Mohr, H Khatri; (III) Provision of study materials or patients: B Cadd; (IV) Collection and assembly of data: B Cadd, H Khatri, S Mohr; (V) Data analysis and interpretation: B Cadd, JC Oosthuizen; (VI) Manuscript writing: All authors; (VII) Final approval of manuscript: All authors.

Correspondence to: Dr. Brandon Cadd, MBBS. Department of Otolaryngology, Head and Neck Surgery, Royal Brisbane Hospital, Queensland, Australia. Email: brandoncadd@gmail.com.

Background: To optimize the work-up of patients with chronic sinusitis, clinically relevant reporting of scans is imperative to prevent serious adverse outcomes intra-operatively. This study aimed to investigate current perceptions of Australian otolaryngologists with the current standard of reporting for CT-sinuses, and importantly, what further content is desired in radiological reports of the CT paranasal sinuses.

Methods: An online survey was sent to all members of the Australasian Society of Otolaryngology, Head and Neck Surgery (ASOHNS). The survey investigated current levels of satisfaction, frequency of inter-specialty communication and more specifically, what further information the ASOHNS community desired when reading radiological reports of the CT sinuses.

Results: The majority of (94.6% of responders) indicated that formal reporting on CT-sinus scans offered little extra clinical information in comparison with their own assessment of patients' scans. When asked specifically what responders were looking for in the reporting of scans 57% requested more information regarding high-risk surgical areas, 28% more information on anatomic variations and 15.83% requested more information pertaining to disease severity and classification.

Conclusions: This study stresses the importance of a systematic approach to the preoperative evaluation of imaging in patients with chronic rhinosinusitis (CRS). The study also highlights perceived potential improvements (from the surgeons' perspective) with regards to the formal reporting of CT scans of the sinuses. High risk surgical areas and anatomical variations were the most frequently noted requests of otolaryngologists. Standardized approaches to the reporting of CT-sinuses, highlighting high-risk areas and anatomical variants would ultimately enhance the pre-operative assessment of patients with CRS.

Keywords: Endoscopic; sinus; surgery; computed tomography (CT); survey

Received: 26 November 2020; Accepted: 25 October 2021; Published: 11 February 2022.

doi: 10.21037/ajo-20-85

View this article at: https://dx.doi.org/10.21037/ajo-20-85

Introduction

With a prevalence ranging from 4.9% to 10.9%, chronic rhinosinusitis (CRS) is a common presentation requiring referral to Ear, Nose and Throat (ENT) specialists (1,2). The potential adverse effects of CRS on quality of life are well documented (3). Furthermore, it is also associated with significant impairment of work productivity and

^ ORCID: 0000-0001-9925-8391.

absenteeism (1,4). For a large proportion of patients, medical therapy (long-term intra-nasal corticosteroids) alone is insufficient to control their symptoms and endoscopic sinus surgery (ESS) is frequently required as an adjunct to medical therapy (5). High-resolution computed tomography (CT) scanning of the paranasal sinuses is a cornerstone in the investigation of CRS and preoperative workup for ESS (6,7). In addition to operative planning, current clinical guidelines utilise objective measures of mucosal disease in order to make a diagnosis of CRS (8-10). One such measure is radiological evidence in the form of the CT paranasal sinuses (8-10).

CT-paranasal sinuses allow the ENT surgeon to evaluate the extent of disease, as well as anatomic abnormalities in patients that predispose them to adverse outcomes (11). A popular mnemonic for the high-risk surgical areas, "CLOSE", has been previously reported in an attempt to standardize reporting of CT-paranasal sinuses and aid in the communication between ENT specialists and radiologists (12). The use of the mnemonic enables concise discussion of the key areas of concern or high-risk injury sites during ESS (12). These areas include the cribriform plate, lamina papyracea, pneumatisation patterns of the ethmoid sinuses (Onodi and Haller cells), sphenoid sinus pneumatization, and (anterior) ethmoidal artery location (12).

The primary objective of this paper is to gain an appreciation for the areas of concern ENT specialists look for when ordering a CT-paranasal sinus, and to communicate the desires of the Australian ENT community with regards to the features on a report perceived as highly valuable, and conversely, those which are perceived to add little to the ENT surgeons' assessment. A secondary aim is to provide a brief introduction to CT reporting and anatomy for those who may be commencing their learning in the area.

"CLOSE" algorithm and clinical significance

As described by Weitzel, Floreani and Wormald in 2008 (13), the CLOSE algorithm was originally developed in conjunction with Dr David Close in Adelaide in order to provide a clinical aid to radiologists and surgeons alike when reviewing CT-paranasal sinuses with particular attention paid to key anatomic landmarks, and variants thereof, which may predispose patients to surgical complications when undergoing ESS (13).

Cribriform plate

The cribriform plate, or lamina cribrosa, is narrow, with deep grooves to house the olfactory bulb, and is traversed by olfactory nerves through olfactory foramina. Fracture or iatrogenic injury of the cribriform plate can lead to a cerebrospinal fluid (CSF) leak, olfactory dysfunction, and potentially infection (meningitis). The olfactory fossa is bordered inferiorly by the lamina cribrosa, and superiorly by the fovea ethmoidalis. Laterally, it is bordered by the lateral lamella, which is the thinnest portion of bone, and thus most vulnerable to intraoperative damage. Injury to the lateral lamella is a high-risk site of iatrogenic injury causing in CSF leak. More specifically, this risk is greatest during ethmoidectomy and clearance of the frontal recess. Such injury and CSF leak may either become evident intraoperatively (in the case of large leaks), or sub-acutely (in the case of smaller leaks). Given that the risk of developing meningitis subsequent to a CSF leak may approach 10–20% per annum (14), this is perceived as a significant complication of ESS with potential for serious morbidity.

The Keros Classification is the most widely used tool for evaluating the maximal depth of the olfactory fossa, thereby establishing the length of the lateral lamellae:

- Keros type I = depth of 1–3 mm (~20% of population);
- Keros type II = depth of 4–7 mm (~75% of population);
- Keros type III = depth of 8–16 mm (~5% of population).

With an increasing depth of olfactory fossa (and increased Keros grade), the lateral lamella length is increased, thereby exposing it to a greater degree to intra-operative damage. It is of note that asymmetry in Keros types, as demonstrated in *Figure 1*, can add to operative risk, and is important to exclude or note in the pre-operative assessment of patients.

Lamina papyracea

The lamina papyracea, or orbital lamina of the ethmoid bone is a thin layer of bone which forms part of the medial orbital wall/lateral wall of the ethmoid sinuses. Occasionally secondary to previous injury or destructive disease processes, the lamina papyracea may be dehiscent, or protrude medially into the ethmoid sinus cavity, as seen in *Figure 2*—if not identified preoperatively, this can be mistaken for an ethmoidal sinus septation during ethmoidectomy and lead to injury of medial orbital

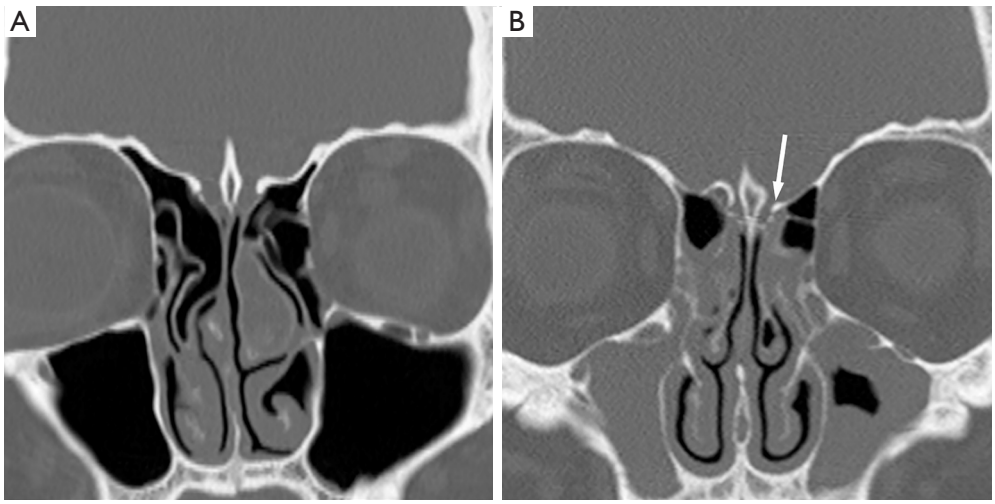

Figure 1 Asymmetrical skull base. Arrow indicates lower position of skull base on patient's left.

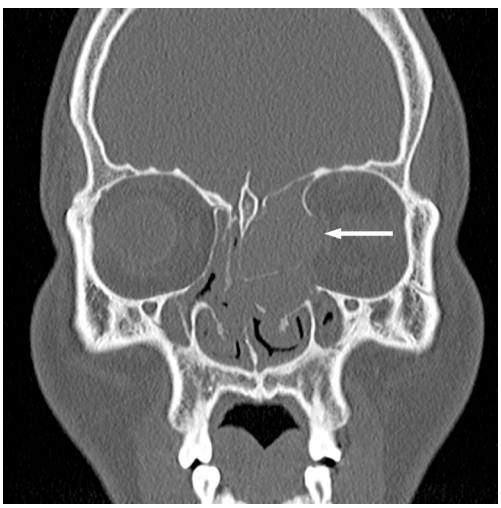

Figure 2 Lamina papyracea dehiscence. Arrow indicates area of dehiscence of lamina papyracea.

structures. A similar pitfall can occur in hypoplastic/atelectatic maxillary sinuses with consequently lateralized uncinate processes and the level of pneumatisation of maxillary sinuses is also of importance in the pre-operative evaluation of the paranasal sinus CT scan.

Onodi (sphenoethmoidal) cells

Onodi cells are posterior variant ethmoidal cells which pneumatise supero-laterally into the sphenoid sinus, potentially leading to pneumatisation around the internal carotid artery and optic nerve. If not recognised, the potential for damage to these two critical structures may occur when entering the sphenoid sinus endoscopically by passing through the posterior wall of an Onodi cell. The contrast between a normal posterior ethmoid/sphenoid configuration and a patient with Onodi cells is demonstrated in *Figure 3*. In *Figure 3A,3B*, we see normal anatomy which is contrasted by the presence of Onodi cells in *Figure 3C,3D*. One potential clue as to the presence of Onodi cells when reviewing coronal images for potential anomalies within the sphenoid sinus is the presence of a horizontal septation or bony division "within" the sphenoid sinus, as seen in *Figure 3C*. Normal sphenoid sinus septations typically approximate the sagittal plane and as such any horizontal appearing septations should alert the surgeon or reviewer of the images to the possibility of an Onodi cell.

Sphenoid sinus pneumatization

The sphenoid sinus is of significant structural complexity, exhibiting three main anatomic variants; chonchal, pre-sellar and sellar, which describes the degree of pneumatisation as well as relative position of the pneumatised portion with regards to the hypophysis/sella turcica. The sphenoid bone forms part of the floor of the middle cranial fossa, in addition to a component of the medial orbital wall. Excessive pneumatization, as encountered in the sellar variant, can result in dehiscence of the optic nerve as well as the internal carotid artery; this renders these structures increasingly susceptible to intraoperative injury. It is crucial when considering sinus surgery involving the sphenoids, to consider variants and extent of sphenoid pneumatization.

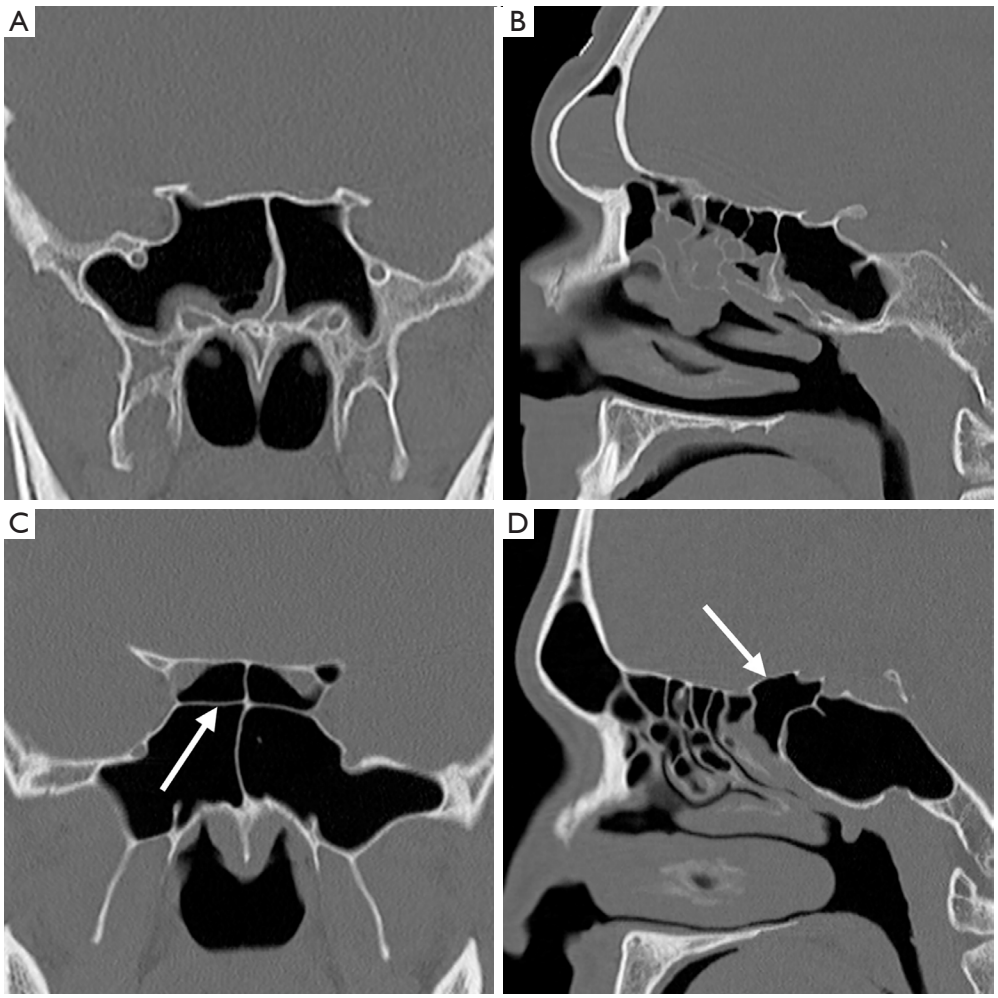

Figure 3 Onodi cell demonstrations. Normal (A,B) and Onodi cell (C,D). Arrows indicate location of Onodi cell.

It has been estimated that the optic nerve and the internal carotid artery are dehiscent within the sphenoid sinus in 4–8% and 4–25% of patients respectively (15,16). Whilst injuries to these structures are rare, when they occur, they can result in life altering and potentially fatal complications (15-18). In *Figure 4A*,*4B* we can see demonstrated dehiscence of the right internal carotid artery within the sphenoid and the left optic nerve respectively.

(Anterior) Ethmoidal artery

The anterior ethmoidal artery (AEA) is a branch of the ophthalmic artery which traverses the skull-base alongside the nasociliary nerve, through the anterior ethmoidal canal. From here it supplies the anterior and middle ethmoidal air cells, frontal sinus, the anterolateral aspect of the lateral nasal wall, as well as the anterior portion of the nasal septum. Travelling along the medial orbital wall, this artery is best viewed in the coronal sections. Supraorbital ethmoid air cells are present in 25–30% on the population (19). When present this is of significant clinical importance, as this predisposes the anterior ethmoidal artery to injury intraoperatively as it travels through the ethmoidal air cells on a bony "mesentery", as can be seen in *Figure 5* (A normal, skull base location of AEA, B, Mesenteric).

While the incidence of intraorbital hemorrhage from AEA injury this is low (approximately 0.3%), early identification and ophthalmological intervention is critical to prevent pressure necrosis, optic nerve ischaemia and ultimately, visual loss (19,20).

We present the following article in accordance with the TREND reporting checklist (available at https://ajo.amegroups.com/article/view/10.21037/ajo-20-85/rc).

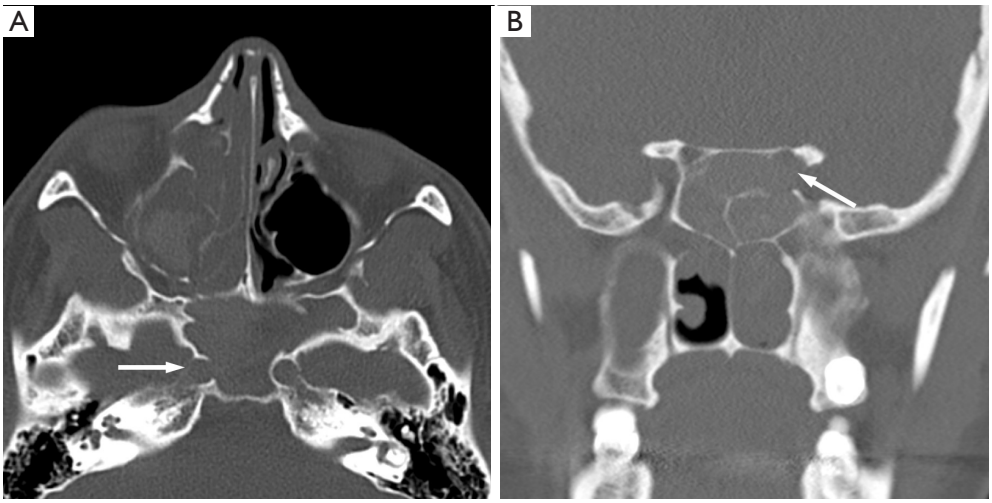

Figure 4 Internal carotid artery (A) and optic nerve dehiscence (B). Arrow indicates location of dehiscence of optic nerve.

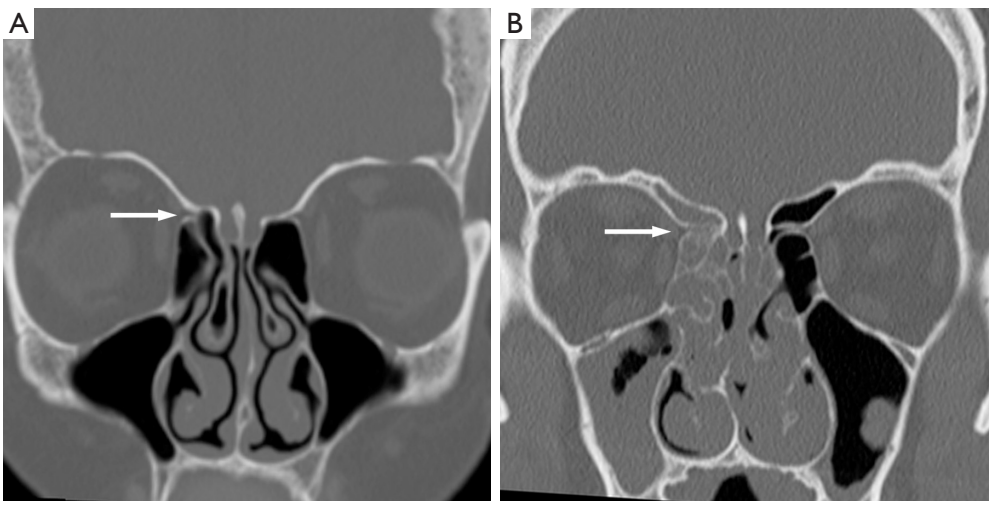

Figure 5 Anterior ethmoid artery demonstration. Arrows indicate location of anterior ethmoid arteries.

Methods

In order to obtain the information for this manuscript the authors polled members of the Australian Society of Otolaryngology, Head and Neck Surgery (ASOHNS) in December of 2019 with regards to their perceptions of current reporting of sinus CT scans as well as their desired content contained in a report. To facilitate this, the ASOHNS members mailing list was utilised as a centralised means of contacting potential respondents. The study was conducted in accordance with the Declaration of Helsinki (as revised in 2013). Ethics approval was obtained from Ipswich Hospital HREC (No. EC00184) as well as being approved by the ASOHNS executive. Informed consent was indicated by voluntary completion of the online survey.

A 7-question survey was designed on an online platform (surveymonkey.com) and the link was subsequently circulated amongst the ENT community through the ASOHNS federal secretariat. Respondents were allowed a 6-week period in which to answer the survey.

Statistical analysis

Simple statistical analysis was performed using Microsoft Excel.

Results

A total of 459 ENT surgeons were sent the survey via electronic mail, of which 129 ENT surgeons responded. Regarding duration of practice, the largest group of responders had >20 years of experience (42.1%). Those with 11–20 years' experience constituted 26.2% of responders and those with 6–10 years and 0–5 years of experience at consultant level made up 19.8% and 11.9% of responders respectively.

Concerning question two of the questionnaire, 65% reported reviewing the images in conjunction with the report, whereas 29.4% of respondents reported not reading the radiology report at all, and 5.6% of surgeons described reading the imaging report prior to reviewing the images themselves. None of the responders reported relying solely on the report for interpretation of the imaging findings.

A total of 122 (94.6%) responders indicated that in their experience, current formal reporting practices for CT-sinus scans offered little extra clinical information in comparison with their own assessment of patients' scans. 45% of surgeons reported contacting a reporting radiologist less than twice a year, 27% reported not contacting their radiology colleagues at all to discuss CTs of the paranasal sinuses and those that contacted their radiology colleagues between 3–5 times per year and more than five times per year made up 19% and 8.7% of the sample respectively.

A total of 120 (93%) of the respondents would prefer additional clinical information in the reporting of CT-sinuses, particularly pertaining to high-risk surgical areas and anatomic variations. Level of disease severity and classification, while still desired by some (15.83% of respondents), was by percentage felt to be the least valuable piece of additional information in sinus CT reporting. Concerning overall contentment with reporting, 24.8% of respondents reported being either dissatisfied or very dissatisfied, meaning that 75.2% of respondents were neither satisfied nor dissatisfied (38%), satisfied (30.23%) or very satisfied (7%) with the standard of reporting they encountered.

When analysed, the responses of the ASOHNs members to the open-ended questions as to what information they would most like to see reported on is displayed in *Table 1*. Of the top ten most requested items, eight represented requests for more anatomical information, in varying forms, whilst the sixth and tenth ranked requests were more information on disease classification/severity of disease and reporting of extra-sinus pathology, respectively.

Discussion

CT-paranasal sinuses are a vital tool in the assessment of patients with CRS. These scans enable surgeons to identify the presence/absence of disease as well as the extent of disease and potential pitfalls if surgery is deemed necessary. Given that CT-paranasal sinuses have become a mainstay in the work-up of patients, ENT surgeons have, by necessity, become adept at reading CT sinuses however there remains a lot to be gained from an alteration in general reporting practices to better inform the pre-operative assessment of patients undergoing sinus surgery. Whilst the interpretation of CT scans of the paranasal sinuses can, at times appear quite straightforward, and for the radiologist, potentially mundane, there are often aspects to interpreting the anatomy which can present a challenge and require a nuanced approach. In this regard, whilst many ENT surgeons have a "working knowledge" of digital image manipulation, it is in this area that the reporting radiologist has the potential to add significant value to the preoperative assessment of the patient with paranasal sinus pathology. Previously, attempts at standardizing reporting have been trialled in the past, with significant traction at their respective facilities once implemented (12,21).

This survey sought to gain a better appreciation of the communication gaps between ENT surgeons and our Radiology colleagues in terms of the pre-operative assessment of patients under investigation and management of paranasal sinus disease. While the majority of surgeons were noted to review the radiological report provided, 28.68% of the respondents to this survey indicated that they reviewed the images without consulting the report at all—it is unclear whether this is simply due to dissatisfaction with current reporting, however the results in terms of percentage are similar to the numbers who reported dissatisfaction with the overall quality of reporting. It is unknown whether these respondents would continue to ignore reporting even if reporting was standardized or contained more pertinent anatomical information. It would however be expected that results which contained more reliable and consistent reporting of key anatomical features reported on by those with the expertise and training required to report on imaging (radiologists) would be less likely disregarded for reasons pertaining to both quality as well as potential medicolegal ramifications.

When scrutinizing the data further, a trend can be seen with the proportion of surgeons primarily concerned with high-risk surgical areas, and their level of surgical

Table 1 Seven Question Survey Sent to ASOHNS Members—CT paranasal sinus reporting

1. How long have you been in practice?
   - o 0–5 years
   - o 6–10 years
   - o 11–20 years
   - o >20 years
2. When reviewing a CT sinus scan in your practice do you MOSTLY:
   - o Review the images only
   - o Review the radiology report prior to reviewing the images
   - o Review the images in conjunction with the radiology report
   - o Review the report only without reviewing the images
3. When viewing the sinus CT images and reading the corresponding radiology report, do you typically find that the radiology report improves your clinical assessment?
   - o Yes, I tend to find that the radiology report improves my clinical assessment
   - o No, I find that the radiology report offers very little additional clinical information to my own assessment
4. How frequently would you contact a radiologist to discuss or review complicated CT sinus scans?
   - o Not at all
   - o Less than twice per year
   - o 3–5 times per year
   - o More than 5 times per year
5. What would you like to see more of in the radiology report?
   - o More information pertaining to disease severity and classifications
   - o More information relating to anatomic variations
   - o More information pertaining to high-risk surgical areas
6. Please list the areas you would most like addressed in a radiology report for CT paranasal sinuses.
   - o Priority 1: _____
   - o Priority 2: _____
   - o Priority 3: _____
7. Overall, how satisfied would you say you are with the quality of radiological reporting you receive with regards to CT paranasal sinuses?
   - o Very satisfied
   - o Satisfied
   - o Neither satisfied nor dissatisfied
   - o Dissatisfied
   - o Very dissatisfied

experience. The most inexperienced population with 0–5 years of consultant level experience were most concerned with high-risk anatomical areas, with 73.3% responding that this was their primary focus in reports. 26.7% of this group was interested in anatomic variations that may complicate surgeries, and 0% indicated that their primary focus in reports was disease severity/classification. This is in comparison with the veteran population with

over 20 years' experience where 45% were still interested in high-risk areas, whereas an additional 34% were more concerned with anatomic variations in scans reported. The general trend of respondents however was indicative of the majority of surgeons (56.7%), regardless of their level of experience, valuing additional information regarding high-risk areas on the imaging, which can be succinctly addressed if the CLOSE algorithm is utilised during CT sinus reporting. Of the top ten requests from the responders in our survey, there exist some requests not covered by the CLOSE mnemonic and those readers inclined to investigate further the reporting of frontal sinuses/frontal recesses would be recommended a review of the 2016 International Frontal Sinus Anatomy Classification (IFAC) (22), in which a structured, comprehensible alternative to the Kuhn classification system is proposed and described. Of note is the high reported frequency of failures of frontal ESS, where more complex anatomy renders successful management of the frontal sinuses more difficult and the narrow operative field, bordered by several vital structures (23). Equally, for those desiring more information pertaining to classification of disease severity, the Lund-Mackay (24) system is commonly used both clinically and in research settings and would be as good a starting point as any for further information. To further elaborate on these topics here is beyond the scope of this paper.

An interesting aspect of the data collection in this paper is the apparently low rate of response to the survey requests. The survey was sent out to ASOHNS members on two occasions and yet the response rate remained relatively low at 28%. This response rate is not inconsistent with previously published rates to online medical surveys (25,26) though does raise the question of how best to obtain valid, representative response rates in an era of "survey fatigue".

As outlined in this manuscript the CLOSE algorithm outlines and aims to identify the main areas of concern in the pre-operative work-up of a patient undergoing ESS. It is of note, and was mentioned by several respondents that the omission of notation of anatomic variations does not necessarily imply the absence thereof in the patient's anatomy, nor does it effectively communicate that the reporting radiologist has considered the areas in question and appraised them as being normal. It is therefore the authors' opinion that that these high-risk anatomic areas should ideally all be succinctly mentioned in any report, with more detail described as and when the need arises. The authors acknowledge that the radiological report for paranasal sinuses has a broader potential audience than solely for the otolaryngology/ENT community and appreciate that as such there may be times that it may be seen as excessive to report on high-risk surgical areas when imaging has been requested by a General Practitioner. In response we would argue the ideal report would remain general enough for interpretation by a non-specialist readership but still contain the high yield surgical information with the use of the CLOSE system, in a fashion similar to the way the TiRADs system for Thryoid Ultrasound has been widely incorporated whilst still allowing for traditional descriptive reporting of thyroid nodules.

Conclusions

In this study we aimed to emphasise the importance of assessment and reporting of high-risk surgical areas in reporting of the preoperative imaging in patients with paranasal sinus disease. The study and survey highlight perceived deficiencies (from the surgeons' perspective) with regards to the formal reporting of CT scans of the sinuses and in particular the absence of reporting of surgical high-risk areas, as well as anatomic variations in patients. As with any other complex medical/surgical conditions, a multi-disciplinary approach to clinical care is ideal in order to optimise patient outcomes and we believe a more formalised approach to the reporting of CT-sinuses, highlighting high risk areas and anatomical variant would ultimately enhance the pre-operative assessment of patients with CRS and other paranasal sinus disease.

Acknowledgments

None.

Footnote

Reporting Checklist: The authors have completed the TREND reporting checklist. Available at https://ajo.amegroups.com/article/view/10.21037/ajo-20-85/rc

Data Sharing Statement: Available at https://ajo.amegroups.com/article/view/10.21037/ajo-20-85/dss

Peer Review File: Available at https://ajo.amegroups.com/article/view/10.21037/ajo-20-85/prf

Funding: None.

Conflicts of Interest: All authors have completed the ICMJE

uniform disclosure form (available at https://ajo.amegroups.com/article/view/10.21037/ajo-20-85/coif). The authors have no conflicts of interest to declare.

Ethical Statement: The authors are accountable for all aspects of this work and ensure that questions related to the accuracy or integrity of any part of the work were appropriately investigated and resolved. The study was conducted in accordance with the Declaration of Helsinki (as revised in 2013). Ethics approval was obtained from Ipswich Hospital HREC (No. EC00184) as well as being approved by the ASOHNS executive. All respondents were fully informed of the voluntary nature of this study and completion of the survey was deemed a demonstration of consent to participate in this research.

References

1. Hastan D, Fokkens WJ, Bachert C, et al. Chronic rhinosinusitis in Europe--an underestimated disease. A GA(2)LEN study. Allergy 2011;66:1216-23.
2. Gross CW, Schlosser RJ. Prevalence and economic impact of rhinosinusitis. Curr Opin Otolaryngol Head Neck Surg 2001;9:8-10.
3. Rudmik L, Smith TL. Quality of life in patients with chronic rhinosinusitis. Curr Allergy Asthma Rep 2011;11:247-52.
4. Rudmik L, Smith TL, Schlosser RJ, et al. Productivity costs in patients with refractory chronic rhinosinusitis. Laryngoscope 2014;124:2007-12.
5. Chiu AG, Kennedy DW. Surgical management of chronic rhinosinusitis and nasal polyposis: a review of the evidence. Curr Allergy Asthma Rep 2004;4:486-9.
6. Kennedy DW, Zinreich SJ, Rosenbaum AE, et al. Functional endoscopic sinus surgery. Theory and diagnostic evaluation. Arch Otolaryngol 1985;111:576-82.
7. Oakley GM, Barham HP, Harvey RJ. Utility of Image-Guidance in Frontal Sinus Surgery. Otolaryngol Clin North Am 2016;49:975-88.
8. Desrosiers M, Evans GA, Keith PK, et al. Canadian clinical practice guidelines for acute and chronic rhinosinusitis. J Otolaryngol Head Neck Surg 2011;40 Suppl 2:S99-193.
9. Fokkens WJ, Lund VJ, Mullol J, et al. EPOS 2012: European position paper on rhinosinusitis and nasal polyps 2012. A summary for otorhinolaryngologists. Rhinology 2012;50:1-12.
10. Rosenfeld RM, Andes D, Bhattacharyya N, et al. Clinical practice guideline: adult sinusitis. Otolaryngol Head Neck Surg 2007;137:S1-31.
11. Ali A, Kurien M, Shyamkumar NK, et al. Anterior skull base: High risk areas in endoscopic sinus surgery in chronic rhinosinusitis: A computed tomographic analysis. Indian J Otolaryngol Head Neck Surg 2005;57:5-8.
12. O'Brien WT Sr, Hamelin S, Weitzel EK. The Preoperative Sinus CT: Avoiding a "CLOSE" Call with Surgical Complications. Radiology 2016;281:10-21.
13. Weitzel EK, Floreani S, Wormald PJ. Otolaryngologic heuristics: a rhinologic perspective. ANZ J Surg 2008;78:1096-9.
14. Daudia A, Biswas D, Jones NS. Risk of meningitis with cerebrospinal fluid rhinorrhoea. Ann Otol Rhinol Laryngol 2007;116:902-5.
15. Maniglia AJ. Fatal and major complications secondary to nasal and sinus surgery. Laryngoscope 1989;99:276-83.
16. Meyers RM, Valvassori G. Interpretation of anatomic variations of computed tomography scans of the sinuses: a surgeon's perspective. Laryngoscope 1998;108:422-5.
17. ELKammasha TH, Enaba MM, Awadallac AM. Variability in sphenoid sinus pneumatization and its impact upon reduction of complications following sellar region surgeries. Egypt J Radiol Nucl Med 2014;45:705-14.
18. McDonald SE, Robinson PJ, Nunez DA. Radiological anatomy of the anterior ethmoidal artery for functional endoscopic sinus surgery. J Laryngol Otol 2008;122:264-7.
19. Han JK, Higgins TS. Management of orbital complications in endoscopic sinus surgery. Curr Opin Otolaryngol Head Neck Surg 2010;18:32-6.
20. Seredyka-Burduk M, Burduk PK, Wierzchowska M, et al. Ophthalmic complications of endoscopic sinus surgery. Braz J Otorhinolaryngol 2017;83:318-23.
21. Vaid S, Vaid N, Rawat S, et al. An imaging checklist for pre-FESS CT: framing a surgically relevant report. Clin Radiol 2011;66:459-70.
22. Wormald PJ, Hoseman W, Callejas C, et al. The International Frontal Sinus Anatomy Classification (IFAC) and Classification of the Extent of Endoscopic

Frontal Sinus Surgery (EFSS). Int Forum Allergy Rhinol 2016;6:677-96.
23. Oakley GM, Barham HP, Harvey RJ. Utility of Image-Guidance in Frontal Sinus Surgery. Otolaryngol Clin North Am 2016;49:975-88.
24. Okushi T, Nakayama T, Morimoto S, et al. A modified Lund-Mackay system for radiological evaluation of chronic rhinosinusitis. Auris Nasus Larynx 2013;40:548-53.
25. Reinisch JF, Yu DC, Li WY. Getting a Valid Survey Response From 662 Plastic Surgeons in the 21st Century. Ann Plast Surg 2016;76:3-5.
26. Zha N, Alabousi M, Katz DS, et al. Factors Affecting Response Rates in Medical Imaging Survey Studies. Acad Radiol 2020;27:421-7.

doi: 10.21037/ajo-20-85
Cite this article as: Cadd B, Khatri H, Mohr S, Oosthuizen JC. Radiological reporting of CT paranasal sinuses: CLOSE to the mark? The Australian otolaryngologists' perspective. Aust J Otolaryngol 2022;5:3.