

| Bibliographic Cite                                                                                                                                                                                                                                                                  | Literature Type                                               | Level of Evidence     | Purpose                                                                                                                                                                                                                                                                                                                  | Population                                                                                                                                                                                                                                                                                                                                       | Intervention and Outcome Measures                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Results/ Recommendations                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Study Limitations                                                                                                                                                                                                                                                                                                                                                                                                                                             |
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| Fraczek M, Guzinski M, Morawska-Kochman M, et al. Investigation of sinonasal anatomy via low-dose multidetector CT examination in chronic rhinosinusitis patients with higher risk for perioperative complications. European Archives of Oto-Rhino-Laryngology. 2017;274(2):787-93. | cross-sectional, uncontrolled, randomised, single-blind study | low level of evidence | To compare visualisation of the surgically relevant anatomical structures via low- and standard-dose multidetector CT protocol in patients with chronic rhinosinusitis (CRS) and higher risk for perioperative complications (i.e. presence of bronchial asthma, history of sinus surgery and advanced nasal polyposis). | Symptomatic, uncomplicated adult patients with CRS admitted to the Department of Otolaryngology at Wrocław Medical University. Patients without bilateral inflammatory changes were excluded.                                                                                                                                                    | Patients were divided randomly into standard-dose (120 kVp, 100 mAs) or low-dose CT groups (120 kVp, 45 mAs). The detectability of the vital anatomical structures (anterior ethmoid artery, optic nerve, cribriform plate and lamina papyracea) was scored using a five-point scale (from excellent to unacceptable) by a radiologist and sinus surgeon. Polyp sizes were quantified endoscopically according to the Lildholdt's scale (LS). Olfactory function was tested with the "Sniffin' Sticks" test. On the low-dose CT images, detectability ranged from 2.42 (better than poor) for cribriform plate among anosmic cases to 4.11 (better than good) for lamina papyracea in cases without nasal polyps. | Identification of lamina papyracea on low-dose scans was significantly worse in each group and the same was the case with cribriform plates in patients with advanced polyposis and anosmia. Cribriform plates were the most poorly identified (between poor and average) among all the structures on low-dose images. Identification of anterior ethmoid artery (AEA) with reduced dose was insignificantly worse than with standard-dose examination. The AEA was scored as an average-defined structure and was the second weakest visualised. Preoperatively, low-dose protocols may not sufficiently visualise the surgically relevant anatomical structures in patients with CRS and bronchial asthma, advanced nasal polyps (LS > 2) and history of sinus surgery. Low mAs value enables comparable detectability of sinonasal landmarks with standard-dose protocols in patients without analysed risk factors. Low mAs value enables comparable detectability of sinonasal landmarks with standard-dose protocols in patients without analysed risk factors. In the context of planned surgery, the current preferences of the tube should be carefully evaluated for different patient constitutions to minimise the risk of complications.                              | Baseline characteristics of the control and experimental groups are different and/or there was no attempt to control for confounding effects; small sample from a single center; subjective measurement of outcomes; the compared protocols were tested in two slightly different groups of patients with no attempt made to control confounding effects; possibility of publication bias since there is an existing publication on the same set of patients. |
| Hirsch SD, Reiter ER, DiNardo LJ, et al. Elimination of pain improves specificity of clinical diagnostic criteria for adult chronic rhinosinusitis. Laryngoscope. 2017;127(5):1011-6.                                                                                               | Retrospective cohort study                                    | low level of evidence | To determine whether the elimination of pain improves accuracy of clinical diagnostic criteria for adult chronic rhinosinusitis.                                                                                                                                                                                         | 1,186 adults referred to an academic otolaryngology clinic with presumptive diagnosis of chronic rhinosinusitis. Exclusion criteria included a history of sinonasal surgery, facial trauma, or prior sinus CT, as well as those without subsequent CT or endoscopic evaluation. Four hundred seventy-nine subjects (40%) met inclusion criteria. | History, symptoms, nasal endoscopy, and computed tomography (CT) results were analyzed. Clinical diagnosis was rendered using the 1997 Rhinosinusitis Taskforce (RSTF) Guidelines and a modified version eliminating facial pain, ear pain, dental pain, and headache.                                                                                                                                                                                                                                                                                                                                                                                                                                            | Among subjects positive by RSTF guidelines, 45% lacked objective evidence of sinonasal inflammation by CT, 48% by endoscopy, and 34% by either modality. Applying modified RSTF diagnostic criteria, 39% lacked sinonasal inflammation by CT, 38% by endoscopy, and 24% by either modality. Using either abnormal CT or endoscopy as the reference standard, modified diagnostic criteria yielded a statistically significant increase in specificity from 37.1% to 65.1%, with a nonsignificant decrease in sensitivity from 79.2% to 70.3%. Analysis of comorbidities revealed temporomandibular joint disorder, chronic cervical pain, depression/anxiety, and psychiatric medication use to be negatively associated with objective inflammation on CT or endoscopy. Clinical diagnostic criteria overestimate the prevalence of chronic rhinosinusitis. Removing facial pain, ear pain, dental pain, and headache increased specificity without a concordant loss in sensitivity. Given the high prevalence of sinusitis, improved clinical diagnostic criteria may assist primary care providers in more accurately predicting the presence of inflammation, thereby reducing inappropriate antibiotic use or delayed referral for evaluation of primary headache syndromes. | Non-consecutive recruitment; Readers were not blinded or no comment was made about the blinding of the readers; Not all patients received the reference ("gold") standard or patients received different reference standards; selection bias                                                                                                                                                                                                                  |
| Julkunen A, Terna E, Numminen J, et al. Inter-observer agreement of paranasal sinus computed tomography scans. Acta Oto-Laryngologica. 2017;137(6):611-7.                                                                                                                           | Comparative Study                                             | low level of evidence | To compare inter-observer agreement of anatomical and surgical structures of sinus CT scans.                                                                                                                                                                                                                             | A random sample of 57 patients suffering from CRS, who were evaluated to benefit from sinus CT scans during 2006–2007 at the Tampere University Hospital, were enrolled to this study.                                                                                                                                                           | The patients underwent routine sinus multiple detector computed tomography (MDCT) examinations for clinical purposes. Lund-Mackay (LM) scores and 43 other structural parameters were analyzed blinded. The reproducibility of the findings between three observers, a radiologist, an ear, nose and throat (ENT) surgeon, and an ENT resident, were compared.                                                                                                                                                                                                                                                                                                                                                    | In general, there was moderate inter-observer agreement of the structures by Cohen's kappa coefficient. Poor reproducibility was observed in the following structures: optic nerve, insertion of the uncinated process, anterior ethmoidal artery, and Keros class. The study demonstrated considerable inter-observer variation in certain surgically important structures. This would indicate the significance for consultation when evaluating sinus CT scans of CRS patients for planned advanced sinus surgery.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Patients with indeterminate results from the diagnostic test were excluded or no comment was made about how indeterminate results were handled; Non-consecutive recruitment; small sample size; retrospective design                                                                                                                                                                                                                                          |

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| Meng Y, Zhang L, Lou H, Wang C. Predictive value of computed tomography in the recurrence of chronic rhinosinusitis with nasal polyps. Int Forum Allergy Rhinol. 2019; 9(11):1236-1243.                                        | Single center prospective | moderate level of evidence | To compare the use of computed tomography (CT) scan with other clinical parameters in predicting the recurrence of chronic rhinosinusitis with nasal polyps (CRSwNP).                                             | A total of 272 consecutive CRSwNP patients undergoing endoscopic functional sinus surgery were recruited. Of these, 230 patients completed the study (118 patients with recurrence of CRSwNP and 112 patients with no recurrence).                                                                                                                                                                                                                                                                                                                | Demographic characteristics and clinical parameters, including CT scores, level of exhaled nitric oxide, and peripheral eosinophilia, were recorded. The degree of infiltration of inflammatory cells in the sinus mucosa was evaluated.                                                                                                                                                                                                                                                                                                                                                                                                      | The average follow-up time was 24 months after the first surgery. The 2 groups were not significantly different with respect to age, gender distribution, comorbid allergy, exhaled oral fractional exhaled nitric oxide levels, nasal obstruction / runny nose / headache / facial pain scores, Lund-Mackay score, peripheral eosinophil percentage, and peripheral eosinophil absolute count. The onset of surgical history and asthma, visual analog scores of CRS, anosmia score, ratio of total ethmoid sinus scores for both sides and maxillary sinus score for both sides (E/M ratio), Lund- Kennedy score, tissue eosinophil percentage, and tissue eosinophil absolute count were significantly higher in the recurrence group. The E/M ratio showed high accuracy as a predictor for CRSwNP recurrence. The cut-off point of 2.55 for E/M ratio indicated the highest predictive value of CRSwNP recurrence. | Single center study. No interobserver variability reported. A total of 42 patients were lost to follow-up.                                                                                                                         |
| Racette SD, Wijewickrama RC, Jayaprakash V, et al. Correlation of Symptoms, Clinical Signs, and Biomarkers of Inflammation in Postsurgical Chronic Rhinosinusitis. Annals of Otolaryngology & Laryngology. 2017;126(6):455-62. | Multicenter Study         | moderate level of evidence | To evaluate symptoms described by patients with chronic rhinosinusitis with polypoid changes/nasal polyps and their correlation with CT, nasal endoscopy, and intranasal biomarkers.                              | Postsurgical chronic rhinosinusitis patients in 59 US centers who previously failed traditional medical and surgical therapy and were subsequently enrolled in a phase 3 clinical trial. Participants included adults over age 18 who were able to speak English and had provided informed consent. All had diagnosis of recurrent postsurgical CRS after sinus surgery for CRS greater than 6 months prior. Those candidates with an acute upper or lower respiratory infection or systemic antibiotic use within the prior month were excluded. | Prospective multicenter study symptom data from postsurgical adult chronic rhinosinusitis study participants with recurrent disease refractory to medical therapy were analyzed in comparison with objective data. Using logistic regression analysis, participant-rated 16-question surveys from 258 participants were assessed for correlation with nasal endoscopy scores, CT percentage of sinus occlusion, and intranasal biomarkers of fungal antigens (Alternaria and Aspergillus), eosinophilic inflammation (eosinophil-derived neurotoxin [EDN] and major basic protein [MBP]), and inflammatory cytokines (interleukins 5 and 13). | Study participant assessments revealed increased CT occlusion in participants presenting with greater inability to smell ( $P < .019$ ). Mucosal inflammation identified on nasal endoscopy was positively correlated with congestion ( $P < .028$ ), runny nose ( $P < .002$ ), and ear pain ( $P < .007$ ). Elevated EDN was positively correlated in patients with bothersome congestion ( $P < .031$ ) and runny nose ( $P < .011$ ). Sneezing was positively correlated with multiple markers: Alternaria ( $P < .024$ ), interleukin-13 ( $P < .027$ ), MBP ( $P < .034$ ), and interleukin-5 ( $P < .019$ ). Nasal endoscopy, not CT imaging, has the strongest correlation with the 2 cardinal symptoms of congestion and runny nose in CRS patients; these correlate with biomarkers of eosinophilic inflammation.                                                                                             | Non-consecutive recruitment; Single reader or no inter-reader reliability was calculated; the use of questionnaires developed through patient described symptoms which may be subjective                                           |
| Sohn HG, Park SJ, Ryu IS, et al. Comparison of clinical presentation and surgical outcomes between recurrent acute rhinosinusitis and chronic rhinosinusitis. Ann Otol Rhinol Laryngol. 2018; 127(11):763-769.                 | Retrospective study       | low level of evidence      | To assess clinical presentations and anatomic variants among patients with recurrent acute rhinosinusitis (RARS), chronic rhinosinusitis (CRS) without nasal polyps (CRSsNP), and CRS with nasal polyps (CRSwNP). | 304 adults aged 18 years and older who were hospitalized for endoscopic sinus surgery between January 2014 and June 2016. There were 130 male and 73 female patients; they had a mean age of 41.65 years (range, 12-82 years).                                                                                                                                                                                                                                                                                                                    | Patients were divided into groups with RARS, CRSsNP, and CRSwNP. Patients had to complete the Sino-Nasal Outcome Test (SNOT-20) on surgery 1 day before and 6 months after surgery. Patient demographics and comorbidities were reviewed. The authors reviewed all patients' computed tomographic findings to analyze anatomic variants.                                                                                                                                                                                                                                                                                                      | No significant differences were found among the average preoperative SNOT-20 scores of the 3 groups. Patients with RARS were significantly more likely to show agger nasi cells, Haller cells, and septal deviation on computed tomography. Those with CRSwNP had significantly smaller mean infundibular widths. All groups showed significantly improved SNOT-20 scores postoperatively. The different anatomic variants found among patients with RARS, CRSsNP, and CRSwNP can facilitate surgical prognostic evaluation.                                                                                                                                                                                                                                                                                                                                                                                            | Author stated limitations include: no control group of patients who didn't undergo surgery; short follow-up (6 months).                                                                                                            |
| Yoon YH, Xu J, Park SK, et al. A retrospective analysis of 538 sinonasal fungus ball cases treated at a single tertiary medical center in Korea (1996-2015). International Forum of Allergy & Rhinology. 2017;7(11):1070-5.    | Retrospective study       | low level of evidence      | To review the authors' experience with cases of sinonasal fungus ball over the past 20 years.                                                                                                                     | Patients who underwent ESS for inflammatory paranasal sinus disease at Chungnam National University Hospital from 1996 to 2015 were included. The mean age was 58.3 years, and the gender ratio was approximately 2 (female): 1 (male).                                                                                                                                                                                                                                                                                                           | The authors retrospectively examined clinical records including clinical presentations, radiological findings, management, and outcomes of FB patients who have undergone surgery for treatment. The number of FB patients who underwent endoscopic sinus surgery (ESS) was calculated annually. Causal relationships between structural variations and FB were also investigated.                                                                                                                                                                                                                                                            | While the most common presenting symptoms of maxillary sinus FB patients were nasal symptoms, such as postnasal drip and nasal obstruction, sphenoid sinus FB patients presented with headache mostly. On computed tomography (CT) scans, the most common finding was intrasellar hyperdensity (77.3%). There was no significant correlation between the presence of FB and structural variations (nasal septal deviation, concha bullosa, Haller cell). Median follow-up period of the patients was 11 months. Recurrence or residual disease occurred in only 6 (1.1%) cases. FB should be considered in patients with unilateral nasal symptoms and unexplained headaches. A preoperative CT scan is an essential tool in making diagnosis easier and faster. Endoscopic surgery is the treatment of choice, with a low morbidity and recurrence rate.                                                               | Non-consecutive recruitment; Readers were not blinded or no comment was made about the blinding of the readers; Single reader or no inter-reader reliability was calculated; incomplete reporting due to its retrospective design. |

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| Zhou AS, Prince AA, Maxfield AZ, et al. The Sinonasal Outcome Test 22 or European Position Paper: Which is more indicative of imaging results? Otolaryngol Head Neck Surg. 2021; 164(1):212-218. | Single center prospective | low level of evidence | To compare the 22-item Sinonasal Outcome Test (SNOT-22) and the European Position Paper on Rhinosinusitis (EPOS) in assessing symptoms of chronic rhinosinusitis to determine if either was more indicative of radiologic findings, to support decisions in telehealth. | Patients were included if they prospectively provided a structured sinonasal history, completed the entire SNOT-22 questionnaire, and underwent sinus CT imaging within 1 month. The structured history included an assessment of symptom duration. Exclusion criteria were the presence of nonnasal chief complaints or lack of either SNOT-22 completion or related imaging within the specified timeframe. 162 consecutive patients with mean age of 46.5 years (range, 18-80), and 68.5% were female. | SNOT-22 scores, EPOS-defined symptom sets, and Lund-Mackay results were assessed. To facilitate direct comparisons, we performed stepwise evaluations of sinonasal symptoms alone and combined with duration. The discriminatory capacity for imaging results was determined through areas under the receiver operating characteristic curves (ROCAUC) for dichotomous outcomes and ordinal regression for multilevel outcomes. | In ROC-AUC analyses, SNOT-22 and EPOS-defined symptoms had similar discriminatory capacity for Lund-Mackay scores, regardless of duration. Within ordinal regression analyses, SNOT-22 nasal scores were significantly associated with Lund-Mackay scores, while EPOS-defined nasal symptoms were not statistically significantly related. The authors conclude that SNOT-22 nasal scores and EPOS-defined nasal symptoms may have similar associations with imaging results when assessed via ROC-AUC, while SNOT-22 may have more association within ordinal data. Understanding the implications of discrete patterns of symptoms may confer benefit, particularly when in-person and fiberoptic exams are limited. | This study has limitations. These include taking place at a single academic institution and using just 2 different measures of patients' symptoms, SNOT-22 and EPOS. In addition, Lund-Mackay thresholds of import are not definitively established, and so we evaluated 2 proposed inflection points, which have limitations. |
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