ORIGINAL CONTRIBUTION

Rhinology, 48, 59-64, 2010

Chronic sinusitis in Malta - correlation between symptoms and CT scan*

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SUMMARY

Introduction: *The diagnosis of chronic rhinosinusitis (CRS) is clinical as it is based on patient symptoms. Sinus CT has been used as an objective measure of CRS with varying degrees of success and correlation to patient symptoms.*

Aims: *This study aimed to investigate the relationship between patient symptoms, nasal endoscopic findings and CT in a small Mediteranean island community. A cohort of 305 consecutive patients with symptoms of CRS, that persisted despite maximal medical therapy, was evaluated by medical history, clinical examination and nasal endoscopy followed by sinus CT. Scans scoring 2 or higher on the Lund-Mckay scoring system were classified as positive for sinusitis while those scoring 0 or 1 were classified as negative for sinusitis.*

Setting: *The setting of this study was a busy otolaryngological practice on a small Mediterranean island using a computerised database.*

Results: *In total, 172 patients (56%) had positive and 133 (44%) had negative CT scans. Males with CRS were significantly more likely to have a positive CT (chi squared test, $p = 0.0005$). Postnasal drip/rhinorrhoea, nasal obstruction and hyposmia as primary symptoms were significantly more likely to be associated with a positive CT (chi squared test $p = 0.0001$). Patients presenting with facial pain as the primary symptom were significantly more likely to have a negative CT (chi squared test, $p = 0.0001$). Middle meatal pus or nasal polyps on nasal endoscopy were significantly more likely to be associated with a subsequently positive CT (chi squared test, $p < 0.0001$). Mucosal oedema of the middle meatus was a non-specific finding.*

CT positive patients were more likely to be treated surgically while CT negative patients were more likely to be treated with medication (chi squared test, $p = 0.0001$).

Conclusion: *Patients were followed up for a mean of 2 years. Overall, there was a good or improved outcome in 81% of patients. Those with a positive CT did significantly well with surgical treatment.*

Key words: chronic, rhinosinusitis, sinusitis, CT, outcome

INTRODUCTION

This study aimed to explore the relationship between symptoms, signs and CT scan findings in a cohort of 305 patients with chronic rhinosinusitis (CRS) in a small Mediterranean island community.

'Rhinosinusitis' has replaced the term 'sinusitis' for infections of the paranasal sinuses since rhinitis and sinusitis usually coexist. CRS has been recognized to have several causative factors and clinicians have acknowledged an incomplete understanding of its aetiology and pathology [(1)].

An American Academy of Otolaryngology task force set up in 1997 defined CRS as consisting of major and minor symptoms [(2)]. 'Major' symptoms included facial pain, congestion, purulent discharge or smell disturbance. 'Minor' symptoms included fever, headache, halitosis, fatigue, dental pain, cough and otalgia. Patients with CRS had to have 2 major symptoms or 1 major and 2 minor symptoms for a duration of at least 12 weeks. These diagnostic criteria for CRS emphasised symptoms rather than objective findings. Specific diagnosis and finding specific aetiology needed further history, examination, nasal endoscopy and CT. CT has been shown to be useful in objective diagnosis and in identifying causative factors for chronic rhinosinusitis [(3)].

The European Position Paper of 2007 updated the definition of CRS. Patients having CRS with or without polyps had to have two or more recognized symptoms for over twelve weeks. These symptoms included nasal obstruction, congestion or nasal discharge (with anterior nasal or postnasal drip), facial pain or pressure, or reduction of the sense of smell [(4)]. Clinical examination ought to elicit endoscopic signs of polyps, mucopurulent discharge or oedema in the middle meatus and be accompanied by radiological signs on sinus CT scan.

*Received for publication: April 4, 2009; accepted: September 22, 2009

DOI:10.4193/Rhin09.066

A lack of close correlation has been recognized between subjective and objective measures of rhinosinusitis [5]. Radiological examination has been considered as one such objective measure. Plain radiographs of the sinuses have been shown to have low specificity and sensitivity when compared to clinical and surgical findings [6]. CT has replaced plain radiographs as the standard test for the assessment of CRS [7] and radiological signs of sinusitis on sinus CT scan included air-fluid levels in the sinuses, mucosal thickening and bony changes.

The Lund-Mckay staging system has been widely used for assessing radiological abnormalities in rhinosinusitis [8-10]. This system correlated well with other markers of disease severity, the nature of surgery and its outcome, and also intraoperative bleeding [11-13]. The Lund-McKay scoring system did not define a cut-off score for a positive or negative scan. A scan with limited mucosal thickening might not necessarily have diagnosed CRS. In a study of 199 patients undergoing CT of the sinuses for non-sinusitis causes, application of the Lund-MacKay system showed that in an asymptomatic population the average score lay between 0 and 5 [14]. Selecting a Lund-Mckay cut-off score to select normal from abnormal, such as greater than 2, increased the sensitivity and specificity for diagnosis of CRS [15].

This study accordingly applied Lund McKay staging, with CT scans having a score of 0 or 1 classified as negative for sinusitis and scans having a score of 2 and above classified as positive for sinusitis.

MATERIALS AND METHODS

Study design

This was a prospective study of 305 consecutive patients fulfilling criteria of CRS who had failed to respond to maximal medical therapy and who went on to have a CT scan of their sinuses, with further surgery as indicated and long-term follow-up. The setting of the study was a busy private otolaryngological practice on the Mediterranean island of Malta where a computerised patient database had been in use for many years. With a population of 390,000 restricted to an area of 313 km^2, long-term follow-up would be easier.

Since data for this study were collected before 2007, the previous 1997 AAO definitions have been used. For inclusion in the study patients with CRS had to have two major or one major and two minor symptoms as described above in the introduction. The symptoms had to be present continually for over 12 weeks with no response to maximal medical therapy. Maximal medical therapy meant repeated courses of combinations of the following: antibiotics, oral antihistamines, oral decongestants, intranasal or oral steroids. Patients were recruited for the study between January 1998 and January 2006. They were followed up until May 2008. Patients were referred by their general practitioner or were self-referred because of persistence of symptoms in spite of medical treatment. Before being recruited into the study they were seen at least once by the author. Another course of medical therapy was given if it was felt this was necessary before conceding treatment failure. In these cases patients were seen twice before inclusion into the study. As long as they satisfied AAO criteria and had failed maximal medical therapy the patients had their CT scan within 24 hours of being seen and were then recruited to the study to be followed up, whether they subsequently had surgery or not. Since some patients stopped attending for follow-up during the time under consideration, a mean follow-up length was calculated.

Patients were asked which of their symptoms of nasal obstruction, facial pain and postnasal drip/rhinorrhoea they found the most disturbing. All other symptoms, including hyposmia/anosmia, were recorded in the clinical interview. The presence of seasonal allergic rhinitis was noted. Patients exposed to cigarette smoke and those with any systemic disease (such as asthma) that could affect long-term outcome were identified.

Endoscopy

Nasal endoscopy was carried out and the principal findings were recorded as normal, purulent rhinorrhoea, polyps or oedema of the middle meatal mucosa.

CT scan

A standard coronal sinus CT was carried out within 24 hours of the clinic visit when it was established that medical therapy was not of benefit. CT scans were carried out by the same radiologist and were evaluated by the author. Patients with a CT having a Lund-McKay score of 0 or 1 were classified as CT negative, including scans just showing turbinate enlargement (rhinitis). Scans with a Lund-McKay score of 2 or over were considered positive for sinusitis. Comparisons were made between patients who were CT positive and those who were CT negative. Anatomical abnormalities such as deviated septum, or conchae bullosa were noted.

Follow-up

During follow-up decisions to operate depended largely on patient symptoms, except in those patients with facial pain and normal CT, who were generally treated medically. Operation was advised in patients with obvious sinusitis and grossly opacified sinuses on CT (these had FESS). Patients with nasal obstruction, due for instance to turbinate hypertrophy or deviated septum with normal sinuses, were operated accordingly to improve the airway. Thus, decision for surgery was not strictly tied to a small CT scoring difference of between 1 and 2. For example a single maxillary polyp was not felt to be an indication for surgery. The type of further medical or surgical treatment was recorded.

Patients were asked whether their outcome was good (significant improvement to quality of life), improved (improvement), same (no change in overall patient symptoms) or worse. The length of follow-up was noted.

Table 1. Sinusitis-positive and sinusitis-negative CT in 141 males and 164 females with clinical CRS. Males with sinus symptoms were significantly more likely to have a positive CT scan than females (chi squared test p = 0.0005).

	Male	Female
CT-positive (n=172)	95	77
CT-negative (n=133)	46	87

Table 2. Principal presenting symptoms in 305 patients with clinical CRS (Chi squared test p = 0.0001). Patients with postnasal drip or nasal obstruction as the main presenting symptom were significantly more likely to have a positive CT.

	Facial Pain	Nasal obstruction	Postnasal drip
CT-positive (n=172)	61	63	48
CT-negative (n=133)	93	31	9
Total numbers (n=305)	154	94	57

Exclusion criteria

Patients with previous surgery were excluded since they may have had bony changes on CT giving rise to misinterpretation. Other exclusion criteria included: cystic fibrosis, immunodeficiency, congenial mucociliary abnormalities (primary cystic dyskinesia), systemic vasculitis, neoplasia including inverted papilloma, fungal disease and cocaine misuse.

RESULTS

A cohort of 305 patients satisfied clinical criteria for CRS and had been unsuccessfully treated with maximal medical therapy. In this study, 164 were female and 141 male. Their mean age was 42.5 years (± 14.9 SD) and their ages ranged between 12 and 81 years.

In total, 172 patients (56.7%) were CT positive with a Lund-McKay score of 2 and above, while 133 patients were CT negative having a score of 0 or 1. The scan in 79 CT-negative individuals merely showed turbinate enlargement (rhinitis) while it was completely normal in 25 patients. The remaining 29 CT-negative scans were normal except for minor anatomical variations such as a deviated septum or conchae bullosae. Similar anatomical abnormalities were also present in 29 CT-positive individuals.

The mean age in patients with CT positive for sinusitis was 45.4 yr (n = 172). Patients with a negative CT had a mean age of 38.8 years (n = 133). Males with sinus symptoms were significantly more likely to have a positive CT scan than females (chi squared test p = 0.0005) (Table 1).

Patients were asked which one symptom caused them most distress. Facial pain was the commonest presenting principal complaint (Table 2), but such patients were significantly less likely to subsequently have a positive CT. Patients with postnasal drip or nasal obstruction as the main presenting symptom were significantly more likely to have a positive CT (chi squared test p = 0.0001).

In this cohort of patients only two volunteered hyposmia or anosmia as one of their principal presenting symptoms. It was possible that in such a chronic condition patients became habituated to loss of sense of smell. Nevertheless, hyposmia or anosmia was a relatively common symptom on direct questioning, and was significantly more likely to be associated with a positive CT (chi squared test, p < 0.0001) (Table 3). Patients with cough were significantly more likely to have a positive CT scan while those with generalised headache were more likely to have a negative CT scan. There was no significant difference with fever, halitosis, toothache, ear pressure or fatigue.

Cigarette smoke exposure, whether active or passive, was not significantly associated with a positive CT (Chi squared test p = 0.27, NS). The great majority of patients were non-smokers.

A past history of systemic illness such as asthma was not associated with an increased likelihood of a CT with Lund-McKay score higher than 2 (Chi squared test p = 0.50, NS). Atopy did not seem to have a significant association with CT outcome in this series of patients.

Fifty CRS patients (16%) gave a history of intermittent or persistent rhinitis. They were not significantly more likely to have a positive CT scan (chi squared test, p = 0.95, NS). Turbinate enlargement, a sign of rhinitis with an otherwise normal CT was seen in 79 (26%) from 305 CRS patients, showing that this condition was clinically underestimated.

Table 4 shows the principal findings on nasal endoscopy as correlated with subsequent findings on CT scan. Patients complaining of postnasal drip, nasal obstruction or hyposmia for over 12 weeks with pus or polyps on nasoendocopy were significantly likely to have Lund-McKay scores of grade 2 or more on their sinus CT. Patients with facial pain and normal or oedematous mucosa on nasoendoscopy were significantly more likely to have a Lund-McKay score of grade 0 or 1.

Table 3. The commonest ancillary symptoms were hyposmia, cough, headache and ear pressure. Patients with hyposmia and cough were significantly more likely to have a subsequently positive CT. Patients with headache were more likely to have a negative CT. *Chi squared test; NS = not statistically significant.

	Hyposmia (p < 0.0001)*	Cough (p=0.001)*	Headache (p=0.04)*	Fever (NS)	Halitosis (NS)	Ear pressure (NS)	Toothache (NS)	Fatigue (NS)
CT-positive (n=172)	45	30	22	6	13	34	7	10
CT-negative (n=133)	9	6	29	2	6	26	4	7

Table 4. Principal Nasal endoscopic findings in CT-positive and CT-negative patients. (*chi squared test for Table overall, $p < 0.0001$).

	Oedema ($p = 0.01$)*	Pus ($p = 0.002$)*	Polyps ($p = 0.00001$)*	Normal ($p = 0.00001$)*
CT-positive (n=172)	57	53	47	15
CT-negative (n=133)	77	15	4	37
Total (n=305)	134	68	51	52

Table 5. Mode of treatment in 305 patients with CRS. CT-positive patients tended to be treated surgically while CT-negative individuals tended to have conservative (medical) treatment (chi squared test $p = 0.0001$). Five patients refused treatment.

	Surgical treatment only	Medication only	Both Medical and Surgical treatment	No treatment
CT-positive (n=172)	98	40	29	5
CT-negative (n=133)	33	77	23	0
All patients (n=305)	131	117	52	5

Mucosal oedema in the middle meatus was significantly more frequent in the CT negative group and seemed to be associated with patients having chronic rhinitis (atopic or non-atopic) rather than CRS. By virtue of their symptoms and AAO criteria this group of patients has been classified as having CRS.

Subsequent treatment after CT was recorded and shown in Table 5. Of all patients, 131 had surgery. CT-positive patients received predominantly surgical treatment while CT-negative patients were generally treated conservatively (chi squared test $p = 0.0001$). Surgical treatment varied from endoscopic sinus surgery to airway correction by means of septoplasty and/or conservative turbinate reduction. Surgical treatment was tailored according to patient symptoms and CT findings, although patient wishes played a part in selection for operation. Occasionally patients fulfilling all criteria for CRS with a positive CT refused surgery. Patients with a negative CT frequently still complained of nasal obstruction due to turbinate hypertrophy and some of these had conservative turbinate reduction. Such patients may have had postoperative steroid spray to maintain a good airway and were considered to have combined therapy. Similarly, patients with nasal polyps had postoperative topical intranasal steroids and were included with the combined therapy group, which numbered 52 in all. One hundred and seventeen patients were treated medically and 75 of these complained of facial pain and had a negative CT. Although these patients satisfied AAO criteria for CRS and were included in the study, their final diagnosis after CT had to be revised to chronic rhinitis with facial pain. They were further treated with some success using amitiptyline, carbamazepine, zolmitriptan, propranolol or Non Steroidal Anti Inflammatory Drugs according to the aetiology of their pain, such as mid-facial pain, trigeminal neuralgia or facial migraine. Twenty-five patients treated medically complained of postnasal drip. From these, 6 had a negative CT - gastroesophageal reflux was considered a possible diagnosis and they were investigated and treated accordingly. Skin testing was another possible avenue for the further investigation of atopy in such patients.

Table 6. Outcome in 305 patients with CRS. Five patients refused treatment (chi squared test, $p = 0.0001$).

	Good outcome	Improved outcome	Same	Lost to follow-up
Surgical (n=131)	106	17	6	2
Medical (n=117)	54	26	18	19
Combined treatment (n=52)	25	19	8	0
No treatment (n=5)	0	0	2	3

Patients were followed up for a mean of 24.2 months with a range from 1 to 120 months. All patients had fulfilled AAO criteria for CRS at entry into the study and all had their CT scan. Twenty-one patients dropped out during follow-up by not attending further, while 3 patients refused the treatment that was advised (Table 6). Patient outcome was recorded as good (significant improvement to quality of life), improved (improvement to quality of life), same (no change in overall patient symptoms) or worse. No patients were worse after treatment.

Surgical treatment gave a significantly better outcome than medical or combined treatment (chi squared test $p < 0.0001$). There were a relatively high number of dropouts in the medical treatment group. Medical treatment was less successful, possibly due to lack of patient compliance with long-term medication or dissatisfaction with treatment efficacy.

DISCUSSION

One drawback of this single-author study was the possibility of bias, although it was balanced by the advantage of familiarity with individual patients, and the correlation by one clinician of all clinical data.

In the AAO 1997 diagnostic criteria for chronic rhinosinusitis, heavy reliance was placed upon patient symptoms. In this paper it was shown that patients can satisfy such criteria and yet have a normal CT. Patients with chronic rhinitis and facial pain were a common example. Rhinosinusits has since been further defined by Stankiewicz as a clinical diagnosis in terms of history and examination supported by endoscopic findings [16]. In 2007 the European Position Paper explained that in the event of failure of medical therapy, endoscopic examination and CT should be carried out to corroborate the history [4]. This study was carried out in the period of time between these

definitions, using the 1997 AAO criteria and attempting to correlate these patients' history with their clinical and radiological findings.
All 305 patients in this study satisfied clinical AAO criteria for CRS. Their symptoms persisted despite maximal medical therapy. The most common symptoms were facial pain, nasal obstruction and postnasal drip. A similar prospective study of 322 patients found their most common major symptoms to be nasal obstruction and facial congestion [17].

Symptoms of sinusitis were compared to an objective indicator, the CT scan. Interpretation of the CT was however, not always straightforward. It has been shown that approximately 30% of asymptomatic adult patients showed incidental mucosal changes on CT [18,19]. Unless CT findings were interpreted with reference to clinical symptoms and physical findings, many patients with incidental changes may have been wrongly diagnosed as having rhinosinusitis. This would have been reflected in subsequent misdirected treatment. A patient with a history suggestive of sinusitis but with a negative CT would probably not have been treated surgically.

From 305 patients, 56% had a positive CT with a Lund-McKay score of 2 and over. Hwang et al. [20] compared symptoms in 115 patients using 1997 task force criteria against CT outcome. From their 115 symptomatic patients, 75 (65%) had a positive CT, defined as a Lund-McKay score of 1 and over.
Stankiewicz [21] studied 78 patients with persistent CRS symptoms despite maximal medical therapy. Using the Metson-Gliklich staging system it was shown that only 47% had opacification, mucosal thickening or an air fluid level on CT.

Facial pain has been an unreliable symptom in predicting CT scan findings [22]. In the present study CRS patients with facial pain were significantly less likely to have a positive CT, although it was their commonest principal presenting symptom. Patients with nasal obstruction, postnasal drip, or hyposmia as the predominant symptoms were significantly more likely to subsequently have a positive CT. Using the patient's single principal presenting symptom may be useful and contrasts with studies where a collection of sinus symptom scores showed poor correlation with CT staging [23].

Nasal endoscopic findings helped significantly in increasing accuracy of diagnosis. Patients with pus or nasal polyps were significantly more likely to subsequently have a positive CT. Those with normal mucosa on nasal endoscopy were more likely to have a negative CT. Mucosal oedema was a common finding on nasal endoscopy. Its frequency may have reflected the high local prevalence of rhinitis [24]. Two main CRS symptoms, that is, facial pain and nasal obstruction, were common symptoms in a study of 415 Maltese patients with chronic atopic and non-atopic rhinitis [25]. Rhinitis was often clinically underestimated as being a source of symptoms mimicking CRS. This was bound to happen as long as patient symptoms remained the basis of diagnosis in CRS.

Systemic disease such as asthma has been thought to be associated with a poor surgical outcome [26] and with increased abnormalities on CT [27]. In this series, systemic disease such as asthma was present in 51 patients. Although systemic illness was commoner in the CT positive group, the likelihood of a positive CT was not statistically increased, possibly because of the small numbers involved.

Overall, patient outcome at 24 months was good or improved in 81% of cases. The outcome was based on broad overall feedback regarding symptoms by patients. No standard quality of life or SNOT questionnaires were used and this could have been a source of error.
The best outcome was observed in patients having surgery. Treatment with medication had a lower success rate and a higher dropout rate. Hessler et al. [28] highlighted the limitations of medical treatment in 84 patients with one-year follow-up. Lack of patient satisfaction could explain the relatively higher rate of patients in this category that were lost to follow-up.

CONCLUSION

In this study of Maltese patients with CRS who have failed maximal medical therapy, the main presenting symptom was important. Postnasal drip, nasal obstruction and hyposmia were significantly associated with a positive CT whereas facial pain was significantly associated with a negative CT. This study highlighted the limitations of diagnosis based solely on patient symptoms. Patients could fully satisfy CRS criteria based on symptomatology and yet at the same time demonstrate a normal CT. Patients with postnasal drip and normal CT should be evaluated for gastroesophageal reflux disease or allergic rhinitis.
The role of a positive CT would be to delineate the anatomy and pattern of inflammatory paranasal disease prior to surgical intervention. A negative CT was useful in order to think of an alternative diagnosis to rhinosinusits.

ACKNOWLEDGEMENTS

The author wishes to thank Dr Sandra Buttigieg, Director, Malta Institute of Health Care and Professor Charles Savona Ventura, University of Malta Medical School for their help with the statistical analyses.

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