Association Between BMI and Nasal Polyposis Chronic Rhinosinusitis Patients

Trisha Shang, BA[1], Simo Kraguljac, BA[2], David Hoying, BS[1], Sarah Kirschling, MS[3], Mohamad R. Chaaban, MD, MSCR, MBA[4]

[1]Case Western Reserve University School of Medicine, [2]University of Central Florida College of Medicine, [3]Department of Quantitative Health Sciences Cleveland Clinic, [4]Head and Neck Institute, Cleveland Clinic

Introduction

Obesity is an ongoing pandemic that increases the severity and risk of multiple inflammatory diseases, such as asthma.[1-4] Asthma is also associated with chronic rhinosinusitis (CRS), with overlapping inflammatory mechanisms.[5] Given this overlap, our objective in this study was to assess the impact of obesity on medical comorbidities in patients with CRS.

Methods

- Retrospective study on adult patients diagnosed with CRS at a single institution between July 1 2020- October 31, 2022.
- Evaluated sinus surgeries, clinical factors, radiologic severity (by Lund-Mackay, LM, scores), and inflammation levels for all CRS patients, grouped as non-obese (BMI < 30 kg/m2) and obese (BMI ≥ 30 kg/m2).
- Clinical factors included: allergic rhinitis, sleep apnea, COPD, asthma, hyperlipidemia (HLD), hypertension (HTN), diabetes, gastroesophageal reflux disease (GERD), nasal polyposis, and CRS biologic medication (including dupilumab, omalizumab, and mepolizumab) prescription.

Results

- N=1,162 patients
- Median age of 57, IQR [42.0, 68.0] at the patient's first CRS diagnosis.
- Median BMI at the time of the patient's CT scan was 28.2, IQR [24.6, 32.8].
- 711 patients were Non-Obese (BMI <30) and 451 were Obese (BMI ≥ 30).

Sinus Surgeries:

- No statistically significant difference in numbers of sinus surgeries comparing obese vs non-obese CRS, CRSwNP, or CRSsNP patients.

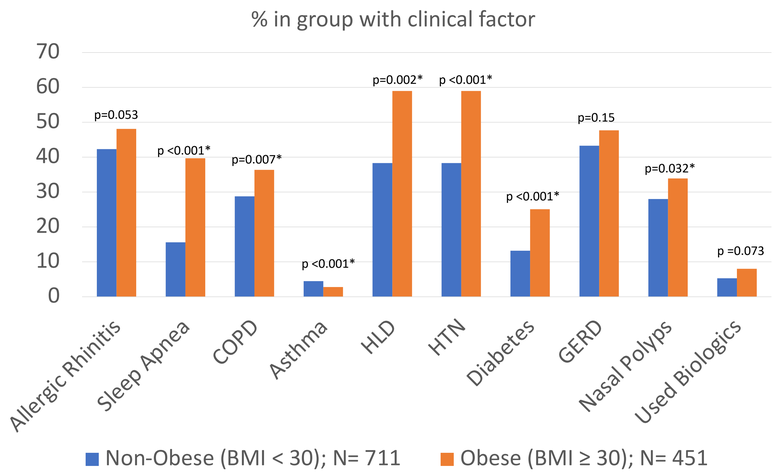

Figure 1. Comparison of clinical features between BMI groups for all CRS patients
* are statistically significant; N=1,162

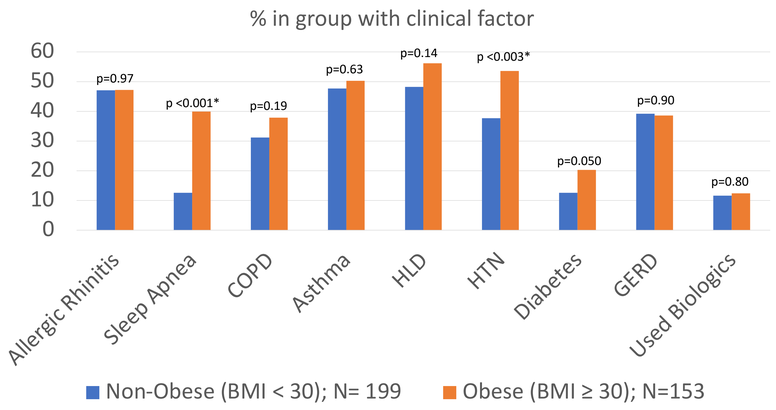

Figure 2. Comparison of Clinical Features between BMI groups for CRSwNP
* are statistically significant; N=352

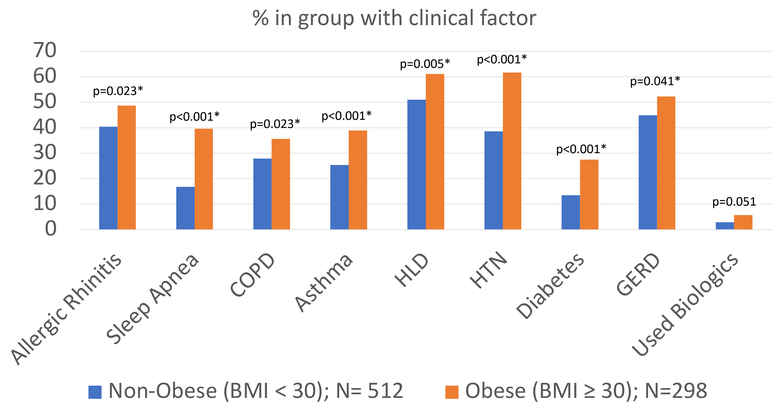

Figure 3. Comparison of Clinical Features between BMI groups for CRSsNP
* are statistically significant; N=810

Table 1. Non-Obese vs Obese Patients with LM Scores above 12 (Pearson's Chi-Squared Test)

	.	Non-obese (BMI<30)		Obese (BMI ≥ 30)		
Population	Total	N	Statistics	N	Statistics	p-value
All CRS patients	251 (21.6%)	711	160 (22.5%)	451	91 (20.2%)	0.35
CRSwNP	173 (49.1%)	199	102 (51.3%)	153	71 (46.4%)	0.37
CRSsNP	78 (9.6%)	512	58 (11.3%)	298	20 (6.7%)	**0.032***

Table 2. Univariate relationships between LM score and several variables of interest

Factor	Patients w/o factor (N, Mean LM ± SD)	Patients w/ factor (N, Mean LM ± SD)	p-value
Allergic rhinitis	644, 7.5 ± 6.5	518, 7.6 ± 6.6	0.79
Sleep Apnea	872, 7.7 ± 6.7	290, 7.0 ± 6.0	0.10
COPD	793, 7.3 ± 6.3	369, 8.1 ± 6.8	**0.037***
Asthma	744, 6.6 ± 5.9	418, 9.3 ± 7.2	**<0.001***
HLD	537, 8.1 ± 6.8	625, 7.1 ± 6.3	**0.008***
HTN	624, 7.8 ± 6.6	538, 7.3 ± 6.5	0.27
Diabetic	955, 7.7 ± 6.5	207, 7.0 ± 6.5	0.21
GERD	639, 8.0 ± 6.6	523, 7.1 ± 6.4	**0.019***
Nasal Polyps	810, 5.5± 5.1	352, 12.3 ± 7.0	**<0.001***

Table 3. Regression analysis of factors associated with LM score

Factor	Estimate	95% CI	p-value
COPD	1.10	(0.99, 1.23)	0.072
Asthma	1.21	(1.09, 1.33)	**<0.001***
GERD	0.93	(0.84, 1.03)	0.17
Nasal Polyps	2.16	(1.96, 2.38)	**<0.001***
HLD	0.91	(0.83, 1.00)	0.053
Obesity	0.89	(0.81, 0.98)	**0.014***

Table 4a. Analysis of factors associated with LM score: Multivariable regression of patients with BMI < 30

Factor	Estimate	95% CI	p-value
Asthma	2.31	(1.39, 3.23)	**<.0001***
Nasal Polyps	6.38	(5.43, 7.33)	**<.0001***
HLD	-1.22	(-2.09, -0.35)	**0.006***
Diabetes	1.44	(0.16, 2.73)	**0.03***

Table 4b. Analysis of factors associated with LM score: Multivariable regression of patients with BMI ≥ 30

Factor	Estimate	95% CI	p-value
Asthma	1.15	(0.10, 2.21)	**0.03***
Nasal Polyps	6.50	(5.40, 7.59)	**<.0001***
Diabetes	-1.36	(-2.55, -0.17)	**0.02***
GERD	-1.17	(-2.21, -0.13)	**0.03***

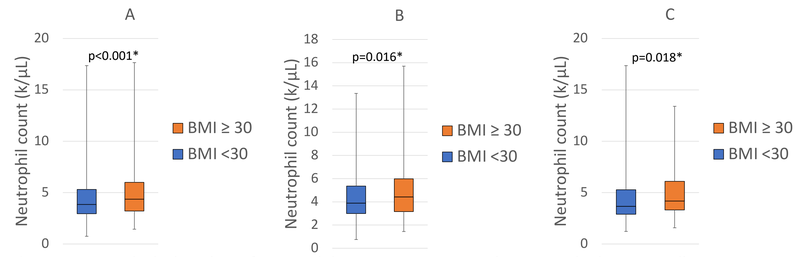

Figure 4. Box and whisker plots of neutrophil counts in patients without vs with obesity. A: All CRS patients, B: CRSsNP patients, C: CRSwNP patients. p values calculated from Wilcoxon Rank Sum test.

Conclusions and Future Directions

There were greater odds of having sleep apnea, COPD, asthma, hyperlipidemia, hypertension, diabetes, and nasal polyps in obese vs non-obese CRS patients. Asthma, nasal polyps, HLD, and diabetes were associated with radiologic severity in non-obese patients, while asthma, nasal polyps, diabetes, and GERD were associated with radiologic severity in patients with obesity. There are more neutrophils in obese vs non obese CRS patients. Future directions involve examining how diabetes medications impact LM score in obese vs non-obese groups.

Contact

Mohamad R. Chaaban MD, MSCR, MBA
Head and Neck Institute, Cleveland Clinic
9500 Euclid Ave., A71, Cleveland, OH 44195, USA
216-385-5391
chaabam@ccf.org

Acknowledgements

This research is supported by the ARS Friends in Research Award.

References

1. Peters U, Dixon AE, Forno E. Obesity and asthma. *Journal of Allergy and Clinical Immunology*. 2018;141(4):1169-1179. doi:10.1016/j.jaci.2018.02.004
2. Sunadome H, Matsumoto H, Izuhara Y, et al. Correlation between eosinophil count, its genetic background and body mass index: The nagahama study. *Allergol Int*. 2020;69(1):46-52. doi: 10.1016/j.alit.2019.05.012.
3. Zeiger RS, Schatz M, Li Q, et al. High blood eosinophil count is a risk factor for future asthma exacerbations in adult persistent asthma. *J Allergy Clin Immunol Pract*. 2014;2(6):741-750. doi: 10.1016/j.jaip.2014.06.005.
4. Rastogi D, Fraser S, Oh J, et al. Inflammation, metabolic dysregulation, and pulmonary function among obese urban adolescents with asthma. *Am J Respir Crit Care Med*. 2015;191(2):149-160. doi:10.1164/rccm.201409-1587OC
5. Matucci A, Bormioli S, Nencini F, et al. Asthma and Chronic Rhinosinusitis: How Similar Are They in Pathogenesis and Treatment Responses?. *Int J Mol Sci*. 2021;22(7):3340. Published 2021 Mar 24. doi:10.3390/ijms22073340