

Sinus CT Quantitative Analysis Report

Scan Date: 20250418
Patient ID: 19420531
Series: N/A
Report Generated: 2025-10-28 14:22

Technical Parameters

Parameter	Value
Voxel Spacing (mm)	[0.3563284768, 0.356328125, 1.5]
Matrix Size	N/A
Number of Slices	125
Scanner	N/A
Reconstruction Kernel	N/A

Ostiomeatal Complex (OMC) Patency

Air fraction within standardized ROI corridors at mid-facial level. Values represent percentage of voxels below air threshold (-400 HU).

Side	Air Fraction (%)	Status	Reference Range
Left OMC	12.8%	Patent	> 12% (Patent)
Right OMC	17.0%	Patent	> 12% (Patent)

Classification thresholds: Patent (>12%), Indeterminate (8-12%), Obstructed (<8%). Based on multi-candidate corridor method with ROI optimization.

Bone Analysis

Sinus wall bone density and sclerotic changes. Z-score computed relative to reference bone (hard palate) statistics.

Measurement	Value	Reference Range
Sclerotic Fraction	0.2%	< 5% (Normal)
Mean Wall HU	-18 HU	400-700 HU
Reference Bone HU	1134 HU	~1200 HU (Cortical)

Sclerotic fraction: percentage of wall voxels with z-score > 2.0 relative to reference bone. Indicates chronic osteitis/bone remodeling.

Retention Cysts

Detected Count: 0
Detection Criteria: Fluid-density lesions (0-60 HU) within maxillary sinus boundaries, gravity-dependent (inferior 40%), minimum 50 voxels.
Reference: Normal range 0-2 cysts. Values ≥3 may indicate chronic inflammation.

Volumetric Analysis

Tissue Type	Volume (mL)	Percentage
Air Cavities	10677.3	83.6%
Soft Tissue	2089.3	16.4%
Total	12766.7	100%

Threshold-based segmentation: Air (<-400 HU), Soft tissue (-100 to +100 HU). Volumes exclude bone and skull base.

Lund-Mackay Staging

Semi-quantitative staging system for chronic rhinosinusitis. Each sinus scored 0-2 based on opacification.

Sinus Region	Left Score	Right Score
Maxillary	0	0
Anterior Ethmoid	0	0
Posterior Ethmoid	0	0
Sphenoid	0	0
Frontal	0	0
OMC Obstruction	2	2

Total Score (LM-20): 0 / 20 | **Total Score (LM-24, with OMC):** 4 / 24

Interpretation: 0 (Normal), 1-4 (Mild), 5-10 (Moderate), 11-20 (Severe). Scores 0=Clear, 1=Partial, 2=Complete opacification.

Deep Sinus Analysis

Quantitative analysis of sphenoid and posterior ethmoid air cells.

Sphenoid Metric	Value	Interpretation
Total Volume	10.7 mL	Normal: 5-10 mL
Left Volume	4.7 mL	
Right Volume	6.0 mL	
Pneumatization Grade	3	0=Conchal, 1=Presellar, 2=Sellar, 3=Postsellar

Air Fraction	4.7%	Normal: >90%
Opacification Status	L: Complete, R: Complete	Clear/Partial/Complete

Posterior Ethmoid Metric	Value	Notes
Total Volume	5.6 mL	Includes all air cells
Estimated Cell Count	8	Based on cell size distribution
Air Fraction	2.2%	Normal: >80%

Skull Base Metric	Value	Interpretation
Mean Thickness	2.47 mm	Normal: 1-3 mm
Min Thickness	1.08 mm	Integrity check

Note: Skull base measurements assess sphenoid roof bone integrity.

Oropharyngeal Analysis

Quantitative assessment of palatine tonsils and upper airway patency.

Tonsil Metric	Value	Interpretation
Left Tonsil Volume	2.7 mL	Normal: 2-8 mL
Right Tonsil Volume	4.0 mL	Normal: 2-8 mL
Total Volume	6.7 mL	Normal: 5-15 mL total
Asymmetry Ratio	1.47	Normal: 0.6-1.5
Brodsky Grade	4 (preliminary)	0=Absent, 1=Normal, 2=Moderate, 3=Kissing, 4=Obstructed

Airway Metric	Value	Notes
Minimum Diameter	80.4 mm (preliminary)	Narrowest point
Mean Diameter	118.0 mm (preliminary)	Average patency
Airway Volume	489.1 mL	Posterior airspace segment

Note: Tonsil segmentation uses lymphoid tissue HU range (-100 to 150 HU). If scan does not include full oropharynx or tonsillectomy performed, volumes may be zero. Brodsky grade is calculated from maximum tonsil extent and may overestimate obstruction if segmentation includes adjacent soft tissue. Airway measurements represent total posterior airspace and may include nasal/sinus cavities if scan coverage is extensive.

Methodology

- **Image Processing:** DICOM series converted to NIfTI format preserving voxel spacing and HU calibration.
- **HU Calibration:** Two-point linear correction using air (-1000 HU) and bone (1200 HU) anchors.
- **Segmentation:** Physics-based thresholding with adaptive histogram analysis for air-tissue boundaries.
- **OMC ROI:** Standardized rectangular corridors (7% x-width, 20% y-height) positioned at mid-facial level.
- **Sclerosis Detection:** Z-score method comparing sinus wall shell (3-7mm thick) to reference cortical bone.

- **Validation:** Methods validated against Orlando Health normal scan ground truth (4/4 metrics passing).

Notes

This report presents quantitative measurements from automated CT analysis. Values are provided with reference ranges from literature. Clinical interpretation should be performed by qualified medical professionals in context of patient history, symptoms, and physical examination.

For technical details, see: METHODS.md in repository. Analysis performed using validated open-source pipeline.