

## **Chapter 2    Coding CT-Classification in Occupational and Environmental Respiratory Disease (OERD)**

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### **Foreword**

The coding system is to be applied as strictly descriptive system and is not diagnostic. It is intended to cover all aspects of occupational and environmental disorders dealing with parenchymal and pleural abnormalities. Although some of the descriptive terms are classically associated with pneumoconiosis{xe "pneumoconiosis"}, for example rounded opacities{xe "rounded opacities"} with silicosis{xe "silicosis"}, or interlobular septal and intralobular non-septal lines and honeycombing with asbestosis{xe "asbestosis"}, these are radiographic patterns that must be carefully considered for an appropriate differential diagnosis reached.

In this coding system neither reference films{xe "reference films"} nor text have precedence over each other. To successfully classify an HRCT study the reader needs to use both text and reference films. For detailed explanation of the terms the reader is referred to chapter 1 on glossary of terms.

For screening{xe "screening"} purposes 6 to 8 slices are taken, distributed over all zones, preferably in the prone{xe "prone"} position. The reading sheet{xe "reading sheet"} has correspondence for each zone. If more than one slice per zone is taken, all findings per zone have to be summarized and classified for each zone{xe "zone"}. See reading sheet{xe "reading sheet"} example (Fig. 2.1).

The "Comments/Summary" Section leaves the opportunity for free text.

CT-Classification									
Name/No.		CT-No. / Date						Quality	Position
		No. slices		Sequential		kV		1	Prone
		Slice thickness		Single slice spir.		mA		2	Supine
		Window settings		Multi slice spiral		sec		3	
								4	

CT-FINDING 2001

Is the film completely negative? No Yes

**Well defined rounded opacities**

No Yes

P = < 1.5 mm	No	Yes	Predominant Size	
Q = 1.5 - 3 mm				
R = > 3 - 10 mm				

**Zones/Protrusion**

	R				L			
U	0	1	2	3	0	1	2	3
M	0	1	2	3	0	1	2	3
L	0	1	2	3	0	1	2	3
<input type="checkbox"/> Sum Grade								

**Irregular and/or linear opacities**

No Yes

	No	Yes	Predominant Type	
Intralobular				
Interlobular				

**Grade**

	R				L			
U	0	1	2	3	0	1	2	3
M	0	1	2	3	0	1	2	3
L	0	1	2	3	0	1	2	3
<input type="checkbox"/> Sum Grade								

**Inhomogeneous attenuation**

No Yes

**Ground glass opacity grade**

No Yes

	R				L			
U	0	1	2	3	0	1	2	3
M	0	1	2	3	0	1	2	3
L	0	1	2	3	0	1	2	3
<input type="checkbox"/> Sum Grade								

**Honeycombing grade**

No Yes

	R				L			
U	0	1	2	3	0	1	2	3
M	0	1	2	3	0	1	2	3
L	0	1	2	3	0	1	2	3
<input type="checkbox"/> Sum Grade								

**Emphysema grade**

No Yes

	R				L			
U	0	1	2	3	0	1	2	3
M	0	1	2	3	0	1	2	3
L	0	1	2	3	0	1	2	3
<input type="checkbox"/> Sum Grade								

**Large opacities**

No Yes

A		R	L
B	U		
C	M		
	L		

**Predominant Parenchymal**

RO	IR	GGO	HC	EM	LO
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Lung

Symbols

Is the film completely negative? No Yes

**Well defined rounded opacities**

No Yes

P = < 1.5 mm	No	Yes	Predominant Size	
Q = 1.5 - 3 mm				
R = > 3 - 10 mm				

**Zones/Protrusion**

	R				L			
U	0	1	2	3	0	1	2	3
M	0	1	2	3	0	1	2	3
L	0	1	2	3	0	1	2	3
<input type="checkbox"/> Sum Grade								

**Irregular and/or linear opacities**

No Yes

	No	Yes	Predominant Type	
Intralobular			</	

Fig. 2.1 Reading Sheet

## Basic Data

Name/No.:

Data for Registration:

CT-Information:

Date and Number

Modality

Sequential CT{xe "CT:Sequential"}

Spiral-Single-Slice CT{xe "CT:Spiral-Single-Slice"}

Spiral-Multi-Slice CT{xe "CT:Spiral-Multi-Slice"}

No. of slices for evaluation – at least 6 reference-slices

Slice thickness{xe "Slice thickness"} – 1-2 mm

Window settings – preferably 2 window settings

Quality{xe "Quality"}:

1 = good; 2 = acceptable, with no technical defect likely to impair classification; 3 = acceptable, with some technical defect but still adequate for classification purposes; 4 = unreadable

Position –preferably prone position at least for the 6 reference slices

## The Initial or Basic question

”Is the film completely negative?”

If “Yes” just fill date and signature at the bottom of the sheet; if “No” the classification has to be done step by step for each item!

## Well defined rounded opacities

Absence (No) or Presence (Yes) has to be reported.

It includes all measurable, well defined rounded opacities{xe "rounded opacities"} from <1.5 mm in diameter (= P{xe "P"}), between 1.5 and 3 mm (= Q{xe "Q"}), to 3 up to 10 mm (= R{xe "R"}).

NOTE: It has to be remembered that hardcopy CT images are diminished and the dimensions of opacities recorded should be true or life size measurements.

The overall distribution is recorded in a grading{xe "grading"} system, regardless of form and size, for each side right (R) or left (L) and each zone of the thorax: upper (U) – arch of the aorta{xe "arch of the aorta"} and above, middle (M) – arch of the aorta down to the inferior pulmonary vein{xe "inferior pulmonary vein"}, lower (L) – inferior pulmonary vein and below including diaphragm{xe "diaphragm"}. The precise definition of the borderline of the zone is not crucial for the application of the system.

0 = no definitive opacities

1 = mild, small opacities definitely present but few in number

2 = moderate, numerous small opacities

3 = severe, small opacities very numerous, normal anatomical lung structures poorly visible

It is possible to check more than one opacity, e.g. P and Q or another combination, and then the predominant size P, Q or R has to be recorded.

Sum of grading, regardless of size, side and zone.

Possible ranging from 0 to 18.

e.g.	R – U – 3	L – U – 2	
	M – 2	M – 1	
	L – 0	L – 0	Sum = 8

## Irregular and/or linear opacities

Absence (No) or Presence (Yes) has to be reported.

Morphologic abnormalities of parenchymal disease: Intralobular opacities,  
Interlobular opacities

Intralobular opacities include dotlike lesions in early asbestosis or hypersensitivity pneumonitis. Subpleural curvilinear opacities are a specific distribution of fibrotic intralobular core structures, paralleling the pleura, few millimetres or less in thickness and usually 1 cm from the pleural surface and are reported as a symbol (“SC”). Parenchymal bands are peripheral linear opacities, branching from the surface of a thickened pleura. They have to be reported with pleural abnormalities separately as a symbol (“PB”). If there is no visible contact to the pleural surface (maybe due to limited number of slices) they should be mentioned as translobular bands and additional explanatory notes should be made without using a symbol.

Mark the absence (X) or presence (X) for each item and predominant type.

The overall distribution is recorded in a grading system, regardless of type, for each side right (R) or left (L) and each zone, upper (U), middle (M) and lower (L):

0 = no definite abnormalities

1 = mild, abnormalities definitely present but few in number

2 = moderate, numerous abnormalities

3 = severe, abnormalities very numerous, normal anatomical lung structures poorly visible

Sum of grading, regardless of type, side and zone.

Possible ranging from 0 to 18.

e.g.	R – U – 0	L – U – 0	
	M – 2	M – 1	
	L – 2	L – 2	Sum = 7

## **Additional parenchymal abnormalities**

Inhomogeneous attenuation:

Absence (No) or Presence (Yes) has to be reported.

Inhomogeneity is possibly due to mosaic perfusion (MP) or ground glass opacity (GGO). In cases where GGO is present, grading has to be done for each side and each zone by judging the extent of the finding:

- 1 = focal
- 2 = patchy
- 3 = diffuse

In a case of mosaic perfusion related to air trapping or vessel obstruction, use only the symbol “MP”.

Honeycombing (HC):

Honeycombing can occur with and without GGO. Absence (No) or Presence (Yes) has to be reported. Irregular opacities within the HC-area are not classified separately.

Grading has to be done for each side and each zone:

- 1 = mild, up to 10 mm in the subpleural parenchyma
- 2 = moderate; >10 to 30 mm in the subpleural parenchyma
- 3 = severe; >30 mm up to whole area of one zone

Emphysema:

Presence (Yes) or absence (No) has to be reported.

Emphysema is graded for right and left side and for all zones.

- 1 = mild, up to 15 % of the area of one zone
- 2 = moderate, between 15 and 30%
- 3 = severe, > 30 %

Differentiation - e.g. acinar, panlobular, subpleural or cicatricial - must be given as a comment. If bullae are present, the symbol “BU” has to be noted.

NOTE: An overall sum of grading for both sides and all zones is required for GGO, Emphysema or Honeycombing.

## **Large opacities**

Absence (No) or Presence (Yes) has to be reported.

Pneumoconiotic as well as non-pneumoconiotic opacities larger than 1 cm in diameter have to be reported. Rounded atelectasis ("RA") is not reported as a large opacity. Usually in case of "RA" there is a definite connection to pleural thickening and this has to be recorded as "Visceral Type" with the symbol "RA".

Opacities are measured in 2 perpendicular axes, as soon as the mean diameter is >1 cm. All large opacities of both sides are combined. Additional symbols can be used, e.g. suspicious for carcinoma = symbol "CA"; for pneumonia = symbol "OD" with additional text.

A = One or more opacities, extent >1 cm up to 1/4 of the area (quadrant) of the right side of the CT-slice at the carina (see Fig. 2.2)

B = Area of one or sum of more opacities larger than „A“, less than 1/2 of the area (2 quadrants) of the right side of the CT-slice at the carina

C = Area of one or sum of more opacities larger than half of the area of the right side of the CT-slice at the carina

## Predominance

Reach a conclusion regarding the predominant finding from the recorded signs:

RO (Rounded opacities)                      IR (Irregular/linear opacities)

GGO (Ground glass opacities)              HC (Honeycombing)

EM (Emphysema)                              LO (Large opacities)

If there are two or more findings in equal predominance, check each of them and give a comment!

## Pleural abnormalities

Two types are differentiated according to the CT appearance: Parietal and Visceral type. Absence (No) or Presence (Yes) has to be reported.

The term "Parietal Type" includes the typical tableland-shape as well as the flat (less elevated) thickening of the pleura without subpleural fibrosis. For classifying there should be no lower limit. If detectable and measurable, it should be reported.

"Visceral Type" is often described as "Diffuse Pleural Thickening" and is always associated with the presence of subpleural fibrosis or parenchymal bands and rounded atelectasis. Additional information is obligatory when a visceral type is reported as pleural abnormality, either irregular and linear opacities or symbols like "PB" or "RA".

At first report the presence (X) or absence (X) for each item, location and predominant type, secondly document the distribution of both types combined for right and left and for each zone!

Extent and Width are reported independently for each side, but again for both types combined.

## Extent:

All abnormalities of the wall and mediastinum except the findings at the diaphragm are measured. Choose the slice with the most extensive pleural thickening for each zone and transfer and add it (virtually) to the slice, positioned at the carina (see drawing, Fig. 2.2). Extent is measured in terms of degrees of the circumference of 360° for each side:

- 1 = up to 90° ( $< \frac{1}{4}$ )
- 2 = > 90° up to 180° ( $\frac{1}{4} - \frac{1}{2}$ )
- 3 = > 180° ( $> \frac{1}{2}$ )

## Width:

The thickest part of the parietal or the visceral type of the 3 chosen slices will be measured:

- a = up to 5 mm
- b = 5 – 10 mm
- c = > 10 mm

Pleural abnormalities of the Mediastinum (“M”) and the diaphragm (“D”) will be documented as absent (X) or present (X).

Findings at the diaphragm are not measured concerning extent and width.

## Pleural calcifications:

Absence (No) or Presence (Yes) has to be reported.

If present, localisation has to be reported for wall (W), mediastinum (M) and diaphragm (D). Per definition the paravertebral space belongs to the wall.

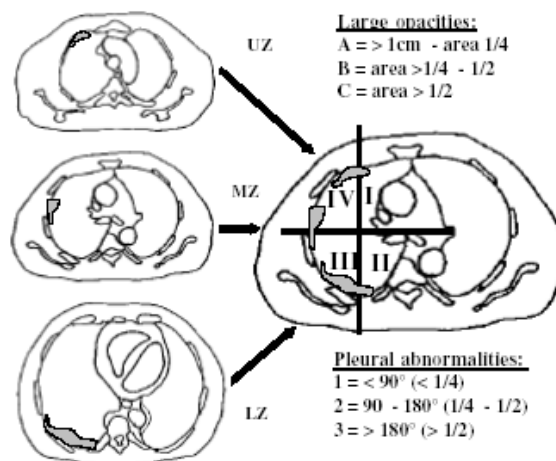


Fig. 2.2. Measurement of Large Opacities and Extent of Pleural Thickening

## Symbols

Symbols describe additional features related to dust exposure and other etiologies. The definitions of symbols assume a qualifying phrase such as “changes indicative of” or “compatible with” (Table 2.1).

Use capital letters to differentiate between ILO-symbols (used for the classification) and CT-symbols.

Table 2.1.

0	None
AX	Coalescence of small pneumoconiotic opacities
BE	Bronchiectasis; all types, including traction bronchiectasis
BR	Bronchial wall thickening
BU	Bullae, additional information on emphysema
CA	Lung Cancer
CG	Calcified Granuloma
CV	Cavity, central necrosis, liquid and/or air containing
DI	Distortion of intrathoracic structures and organs
DO	Dependent Opacity
EF	Effusion, free or loculated pleural fluid
ES	Eggshell calcification of hilar and/or mediastinal lymph nodes
FP	Fat Pad, extrapleural/subcostal fat
FR	Fractured Rib (s)
HI	Enlargement of hilar and/or mediastinal lymph nodes, >1,5-2 cm
ME	Malignant Mesothelioma of the pleura, the pericardium or the peritoneum
MP	Mosaic Perfusion
OD	Other Disease; comments under „Additional Findings“
PB	Parenchymal Band, due to pleuroparenchymal scars
RA	Rounded Atelectasis
SC	Subpleural curvilinear lines
TB	Tuberculosis
TD	Tree in Bud

## Comments/Summary

### Comments

Additional information on each paragraph can be documented. If there are findings which are not covered by the evaluation sheet, e.g. descriptive terms for particular patterns of intralobular opacities, they can be mentioned in this section of the Reading Sheet (Fig. 2.1).



### Summary

A conclusive summary is necessary, e.g. findings are compatible with occupational or non-occupational disease, differential diagnostic considerations should be mentioned.

### References

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