

## *Additional files*

### *A: Overview of all lumbar EU-image criteria, important details and general assessment*

#### **1. LUMBAR SPINE AP/PA Projection (figure 1)**

##### **1.1. Image Quality Assessment Criteria**

- 1.1.1. Visually sharp reproduction, as a single line, of the upper and lower-plate surfaces in the centered beam area.
- 1.1.2. Visually sharp reproduction of the pedicles.
- 1.1.3. Reproduction of the intervertebral joints.
- 1.1.4. Reproduction of the spinous and transverse processes.
- 1.1.5. Visually sharp reproduction of the cortex and trabecular structures.
- 1.1.6. Reproduction of the adjacent soft tissues, particularly the psoas shadows.
- 1.1.7. Reproduction of the sacro-iliac joints.

##### **1.2. Important Image Details**

- 1.2.1. Visually details down to 0.3-0.5 mm.

##### **1.3. General Assessment**

- 1.3.1. Image acceptability.

#### **2. LUMBAR SPINE Lateral L1-L4 Projection (figure 2)**

##### **2.1. Image Quality Assessment Criteria**

- 2.1.1. Visually sharp reproduction of the upper and lower-plate surfaces, represented as lines with the resultant visualization of the intervertebral spaces.
- 2.1.2. Full superimposition of the posterior vertebral edges.
- 2.1.3. Reproduction of the pedicles and the intervertebral foramina.
- 2.1.4. Visualization of the spinous processes.
- 2.1.5. Visually sharp reproduction of the cortex and trabecular structures.

##### **2.2. Important Image Details**

- 2.2.1. Visually details down to 0.5 mm. at 3<sup>rd</sup> lumbar vertebral body, ventral edge.

##### **2.3. General Assessment**

- 2.3.1. Image acceptability.

#### **3. LUMBAR SPINE Lateral L5/S1 Projection (figure3)**

##### **3.1. Image Quality Assessment Criteria**

- 3.1.1. Reproduction by tangential production of the inferior end plate of L5 and the superior end plate of S1.
- 3.1.2. Visualization of the spinous process of L5.
- 3.1.3. Visualization of the anterior border of the upper sacrum.
- 3.1.4. Reproduction of the vertebral pieces of the upper sacrum.

##### **3.2. Important Image Details**

- 3.2.1. Linear and reticular details down to 0.5 mm. in width.

##### **3.3. General Assessment**

- 3.3.1. Image acceptability.

## *B: Variable definitions of the EU-image criteria and scoring principles for quality*

### **1. LUMBAR SPINE AP/PA Projection (figure 1)**

#### **1.1. Image Quality Assessment Criteria \***

- 1.1.1. Visually sharp reproduction of the upper and lower-plate surfaces, represented as lines in the centered beam area.
- 1.1.2. Visually sharp reproduction of the pedicles.
- 1.1.3. Reproduction of the intervertebral joints (apophyseal or facet).
- 1.1.4. Reproduction of the spinous and transverse processes.
- 1.1.5. Visually sharp reproduction of the cortex and trabecular structures.
- 1.1.6. Reproduction of the adjacent soft tissues, particularly the psoas shadows.
- 1.1.7. Reproduction of the sacro-iliac joints.

#### **1.2. Important Image Details\*\***

- 1.2.1. Image details (3<sup>rd</sup> lumbar vertebral body) down to 0.3-0.5 mm.

#### **1.3. General Assessment \*\*\***

- 1.3.1. Image acceptability.

#### **1.4. Scoring principles (maximum 11 points)**

##### **1.4.1.\*Image Quality Assessment Criteria**

Image criteria fulfilled = 1

Image criteria is not fulfilled = 0

##### **1.4.2.\*\* Important Image Details**

Image details fulfilled = 1

Image details not fulfilled = 0

##### **1.4.3.\*\*\* General Image Acceptability**

Fully acceptable = 3

Probably acceptable = 2

Only acceptable under limited clinical conditions = 1, give reasons (see below)

Unacceptable = 0, give reasons (see below)

#### **Possible reasons for diminished image quality:**

**Noise**, defined as grainy, random fluctuations in the image which superimpose the image pattern (\* = Optimal; - = Suboptimal; 0 = Unacceptable)

**Contrast**, defined as differences in optical density between object and background (\* = Optimal; + = Too high; - = Too low)

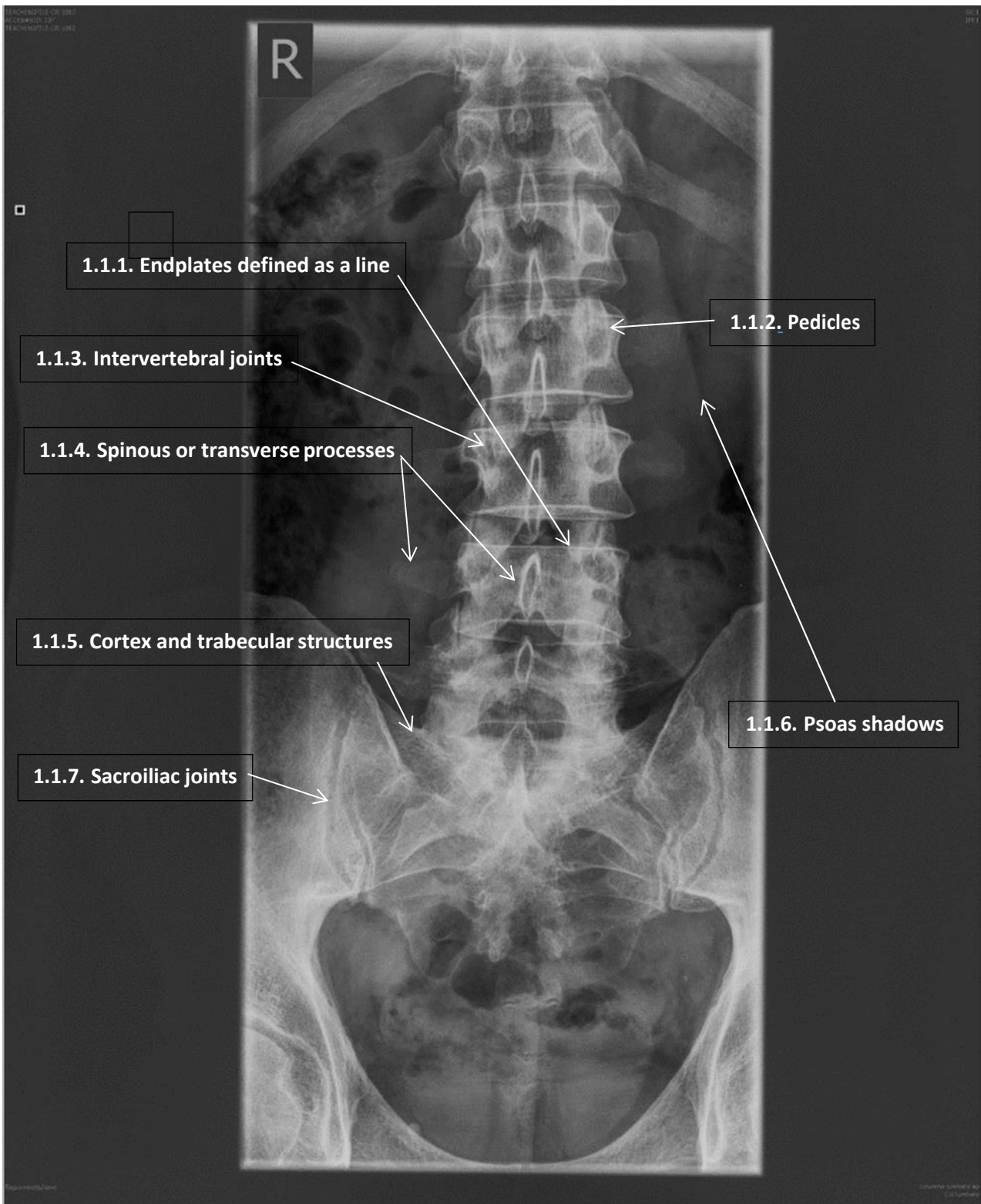
**Sharpness**, defined as the extent of the transition zone for optical density between object and background (\* = Optimal; - = Sub-optimal; 0 = Unacceptable)

**Collimation**, defined as beam limitation

(\* = Optimal; + = Field size too large; - = Field size too small)

**Patient positioning**, defined as mal-positioning of the patient in relation to the x-ray field (\* = Optimal; - = Sub-optimal; 0 = Unacceptable)

Figure 1:



## 2. LUMBAR SPINE Lateral L1-L4 Projection (figure 2)

### 2.1. Image Quality Assessment Criteria \*

- 2.1.1. Visually sharp reproduction of the upper and lower-plate surfaces, represented as lines with the resultant visualization of the intervertebral spaces.
- 2.1.2. Full superimposition of the posterior vertebral edges.
- 2.1.3. Reproduction of the pedicles and the intervertebral foramina.
- 2.1.4. Visualization of the spinous processes.
- 2.1.5. Visually sharp reproduction of the cortex and trabecular structures.

### 2.2. Important Image Details\*\*

- 2.2.1. Visually details down to 0.5 mm. at 3<sup>rd</sup> lumbar vertebral body, ventral edge.

### 2.3. General Assessment \*\*\*

- 2.3.1. Image acceptability.

### 2.4. Scoring principles (maximum 9 points )

#### 2.4.1.\*Image Quality Assessment Criteria

Image criteria fulfilled = 1

Image criteria is not fulfilled = 0

#### 2.4.2.\*\* Important Image Details

Image details fulfilled = 1

Image details not fulfilled = 0

#### 2.4.3.\*\*\* General Image Acceptability

Fully acceptable = 3

Probably acceptable = 2

Only acceptable under limited clinical conditions = 1, give reasons (see below)

Unacceptable = 0, give reasons (see below)

#### **Possible reasons for diminished image quality:**

**Noise**, defined as grainy, random fluctuations in the image which superimpose the image pattern (\* = Optimal; - = Suboptimal; 0 = Unacceptable)

**Contrast**, defined as differences in optical density between object and background (\* = Optimal; + = Too high; - = Too low)

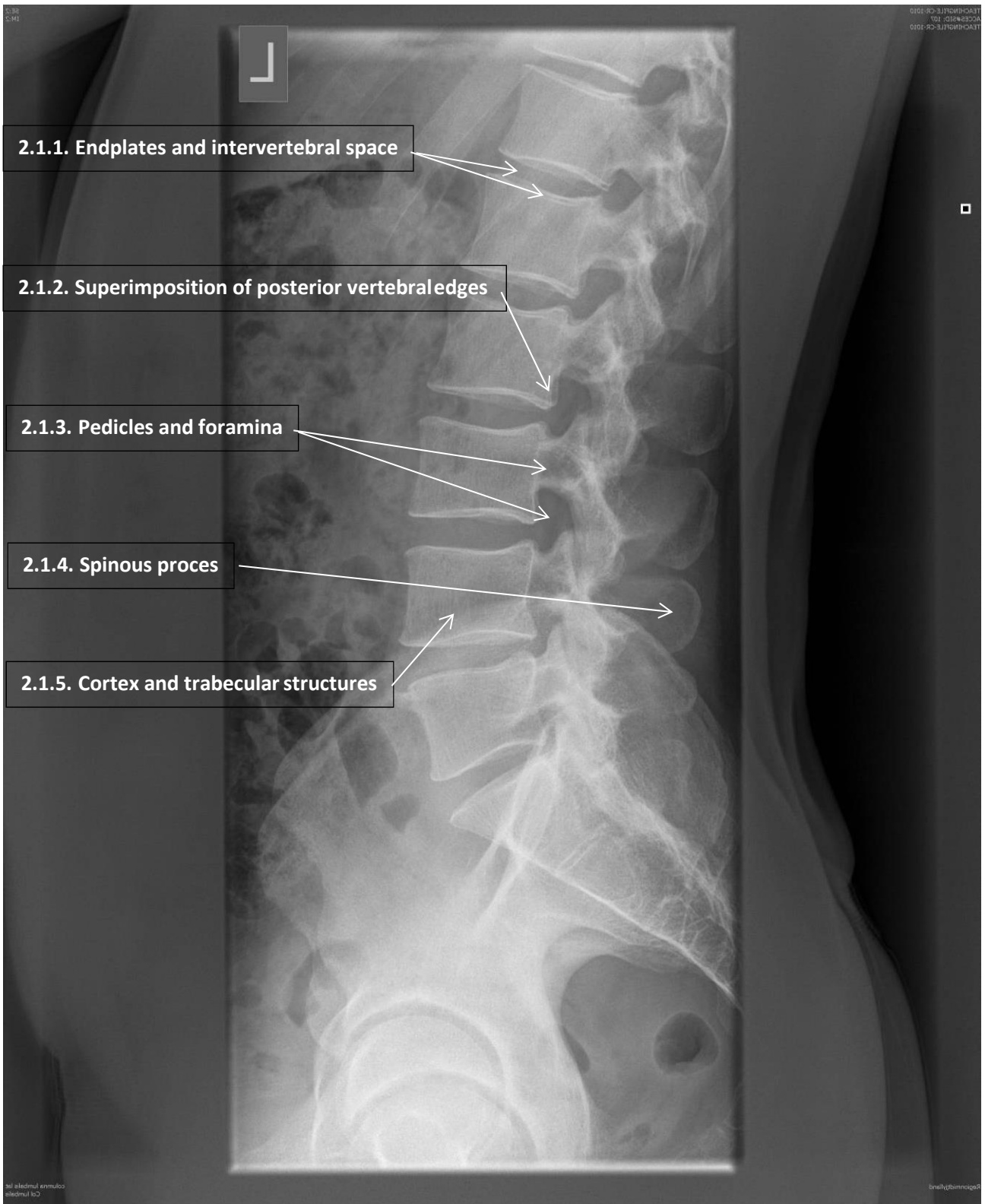
**Sharpness**, defined as the extent of the transition zone for optical density between object and background (\* = Optimal; - = Sub-optimal; 0 = Unacceptable)

**Collimation**, defined as beam limitation

(\* = Optimal; + = Field size too large; - = Field size too small)

**Patient positioning**, defined as mal-positioning of the patient in relation to the x-ray field (\* = Optimal; - = Sub-optimal; 0 = Unacceptable)

Figure 2:



### 3. LUMBAR SPINE Lateral L5/S1 Projection (figure 3)

#### 3.1. Image Quality Assessment Criteria \*

- 3.1.1. Reproduction by tangential production of the inferior end plate of L5 and the superior end plate of S1.
- 3.1.2. Visualization of the spinous process of L5.
- 3.1.3. Visualization of the anterior border of the upper sacrum.
- 3.1.4. Reproduction of the vertebral pieces of the upper sacrum.

#### 3.2. Important Image Details \*\*

- 3.2.1. Linear and reticular details down to 0.5 mm. in width.

#### 3.3. General Assessment \*\*\*

- 3.3.1. Film acceptability.

#### 3.4. Scoring principles (maximum 8 points)

##### 3.4.1.\*Image Quality Assessment Criteria

- Image criteria fulfilled = 1
- Image criteria is not fulfilled = 0

##### 3.4.2.\*\* Important Image Details

- Image details fulfilled = 1
- Image details not fulfilled = 0

##### 3.4.3.\*\*\* General Image Acceptability

- Fully acceptable = 3
- Probably acceptable = 2
- Only acceptable under limited clinical conditions = 1, give reasons (see below)
- Unacceptable = 0, give reasons (see below)

#### Possible reasons for diminished image quality:

**Noise**, defined as grainy, random fluctuations in the image which superimpose the image pattern (\* = Optimal; - = Suboptimal; 0 = Unacceptable)

**Contrast**, defined as differences in optical density between object and background (\* = Optimal; + = Too high; - = Too low)

**Sharpness**, defined as the extent of the transition zone for optical density between object and background (\* = Optimal; - = Sub-optimal; 0 = Unacceptable)

**Collimation**, defined as beam limitation

(\* = Optimal; + = Field size too large; - = Field size too small)

**Patient positioning**, defined as mal-positioning of the patient in relation to the x-ray field (\* = Optimal; - = Sub-optimal; 0 = Unacceptable)

Figure 3:

