ACR Prostate MR course

Prostate Imaging Quality System
PI-QUAL

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Disclosures

- Consulting agreement – Koelis
- Research support and consulting agreement with Blue Earth Diagnostics
Objective

• To review the Prostate Imaging Quality System (PI-QUAL).
Prostate MRI

“How it started”

“How it is going”

“PI-RADS 4 Lesion in the right mid posterolateral PZ”
Prostate MRI

LIFE

Expectation  vs  Reality
Background

Quality of Prostate MRI: Is the PI-RADS Standard Sufficient?

- Image quality is inconsistent and unreliable
- Poor compliance with PI-RADS standards
- PI-RADS compliance does not guarantee high-quality images
- Great variability across centers and within centers

Importance of Image Quality

- Exam reproducibility
- Lesion detection
- Lesion characterization
- Lesion localization
- Prostate/lesion segmentation for biopsy
- Tumor staging (EPE/SVI)
- Lesion follow up
- Quantitative assessment
- AI implementation
- Confidence in exam results
PI-QUAL

- Developed to evaluate the quality of prostate MR images for the PROMIS trial.
- Has been validated and accepted as an international standard
- Evaluates the compliance with PI-RADS technical parameters and a set of subjective criteria for the quality of each pulse sequence
- 5-point scale to convey the diagnostic capability of prostate MRI exam.
How to use PI-QUAL

“Adequate means compliant with PI-RADS technical standards”

<table>
<thead>
<tr>
<th>T2-WI</th>
<th>DWI</th>
<th>DCE</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Technical parameters</strong></td>
<td><strong>Technical parameters</strong></td>
<td><strong>Technical parameters</strong></td>
</tr>
<tr>
<td>Axial plane</td>
<td>Axial plane matching T2-WI</td>
<td>Axial plane matching T2-WI</td>
</tr>
<tr>
<td>Sagittal or coronal plane</td>
<td>Adequate field of view</td>
<td>Adequate field of view</td>
</tr>
<tr>
<td>Adequate field of view</td>
<td>Adequate in-plane resolution</td>
<td>Adequate in-plane resolution</td>
</tr>
<tr>
<td>Adequate in-plane resolution</td>
<td>Adequate slice thickness</td>
<td>Adequate slice thickness</td>
</tr>
<tr>
<td>Adequate slice thickness</td>
<td>Multiple [&gt; 2] b values acquired</td>
<td>Pre-contrast T1-WI available</td>
</tr>
<tr>
<td>Z-axis correctly positioned</td>
<td>High b value (synthesised or acquired)</td>
<td>Fat suppression/subtraction</td>
</tr>
<tr>
<td><strong>Visual assessment</strong></td>
<td><strong>Visual assessment</strong></td>
<td><strong>Visual assessment</strong></td>
</tr>
<tr>
<td>Capsule clearly delineated</td>
<td>Adequate ADC map</td>
<td>Capsular vessels clearly delineated</td>
</tr>
<tr>
<td>Seminal vesicles clearly delineated</td>
<td>Absence of artefacts (e.g. rectal air)</td>
<td>Vessels in the Alcock’s canal clearly delineated</td>
</tr>
<tr>
<td>Ejaculatory ducts clearly delineated</td>
<td></td>
<td>Absence of artefacts (e.g. movement)</td>
</tr>
<tr>
<td>Neurovascular bundles clearly delineated</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sphincter muscle clearly delineated</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Absence of artefacts (e.g. movement)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Is T2-WI of diagnostic quality?  
☐ Yes  
☐ No

Is DWI of diagnostic quality?  
☐ Yes  
☐ No

Is DCE of diagnostic quality?  
☐ Yes  
☐ No
# Prostate Imaging QUALity control (PI-QUAL) scoring sheet

<table>
<thead>
<tr>
<th>PI-QUAL score</th>
<th>Criteria</th>
<th>Clinical implications</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>All mpMRI sequences are below the minimum standard of diagnostic quality</td>
<td>It is NOT possible to rule in all significant lesions §</td>
</tr>
<tr>
<td>2</td>
<td>Only one mpMRI sequence is of acceptable diagnostic quality</td>
<td>It is NOT possible to rule out all significant lesions §</td>
</tr>
<tr>
<td>3</td>
<td>At least two mpMRI sequences taken together are of diagnostic quality</td>
<td>It is possible to rule in all significant lesions</td>
</tr>
<tr>
<td>4</td>
<td>Two or more mpMRI sequences are independently of diagnostic quality</td>
<td>It is NOT possible to rule out all significant lesions</td>
</tr>
<tr>
<td>5</td>
<td>All mpMRI sequences are of optimal diagnostic quality</td>
<td>It is possible to rule in all significant lesions</td>
</tr>
<tr>
<td></td>
<td></td>
<td>It is possible to rule out all significant lesions</td>
</tr>
</tbody>
</table>

§ Therefore reports should not include PI-RADS or Likert scores

Please (✓) if present: (note: ‘adequate’ means compliant with the technical specifications reported in PI-RADS v. 2 guidelines) *
PI-QUAL Limitations

- Strict compliance with PI-RADS technical parameters may not be necessary (and can be difficult to achieve on 1.5 T scanners).
- Visual criteria is subjective
- Lacks clarity on how to derive the final score
  - “Taken together are of diagnostic quality”
  - “Independently of diagnostic quality”
  - “Optimal”
- Does not add weight to pulse sequences
  - PI-QUAL 4 with inadequate DWI ≠ PI-QUAL 4 with adequate DWI
- A new version is under development.
ACR Prostate MR Image Quality Improvement Collaborative

- **Optimal**: PI-RADS compliant AND has no artifacts
- **Adequate**: Compliant with critical PI-RADS technical standards AND/OR has artifacts that do not compromise image interpretation
- **Inadequate**: Non-compliant with critical PI-RADS technical standards AND/OR has artifacts that compromise image interpretation

mPI-QUAL 1: All sequences are Inadequate
mPI-QUAL 2: Only 1 sequence is Adequate/Optimal
mPI-QUAL 3: Two or more sequences are Adequate
mPI-QUAL 4: Two sequences are Optimal
mPI-QUAL 5: All sequences are Optimal
“Multidisciplinary teams from different organizations share and learn from each other as they work to develop and apply methods to improve a defined aspect of care in their respective organizations.”

“To create a standardized system for increasing the percentage of MR prostate exams that meet quality criteria according to the Prostate Image Quality system.”
Why should you use PI-QUAL?

- Standardized method for communicating exam quality, which you already do, but not in a standardized fashion.
- A valuable tool for QC.
- Increases referral confidence in making decisions based on exam results.

- You should not assign a PI-RADS score in PI-QUAL ≤ 2 studies.
Thank you!