

MedVLM-R1: Incentivizing Medical Reasoning Capability of Vision-Language Models (VLMs) via Reinforcement Learning

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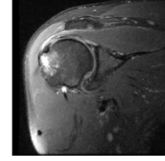
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Question Template

What can be observed in this image?

A) Cartilage degeneration B) Labral pathology
C) Bone fracture D) Tendonitis



Model Input Prompt

{Question} Your task:

1. Think through the question step by step, enclose your reasoning process in <think>...</think> tags.
2. Then provide the correct single-letter choice (A, B, C, D,...) inside <answer>...</answer> tags.
3. No extra information or text outside of these tags.

Model Output Examples

<think> The image is a grayscale MRI image of an upper arm joint. The bicondylar humeral head of the humerus is visible. There is a well-defined ... </think>
<answer>B, there is no clear indication of ... </answer>

Format Reward = 1 due to the present of all tags and no content outside the tags

Accuracy Reward = 0.5 due to extra explanation appended after the answer

Fig. 1: The template of our employed prompt, an example of model's response and reward criterion.

Problem 1: What can be observed in this image?

A) Lungs B) Bladder C) Brain D) Heart

MedVLM-R1 Output:

<think>
The image is a chest X-ray, which is a type of radiographic image used to visualize the internal structures of the body, particularly the lungs and bones. The presence of lung markings and the ribcage are characteristic features of a chest X-ray.
</think>

<answer>A</answer> **Groundtruth Answer: A**



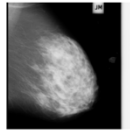
Problem 2: What content appears in this image?

A) Cardiac tissue, B) Breast tissue, C) Liver tissue, D) Skin tissue

MedVLM-R1 Output:

<think> The image appears to be a mammogram, which is a type of X-ray used to detect abnormalities in the breast tissue. The image shows the breast tissue with various densities and patterns, which are typical of mammograms. </think>

<answer>B</answer> **Groundtruth Answer: B**



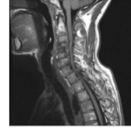
Problem 3: What is the finding in this image?

A) Stomach ulcer, B) Nerve compression, C) Cord pathology, D) Liver cirrhosis

MedVLM-R1 Output:

<think> To determine the correct answer, we need to identify the finding in the image provided. The MRI scan in question is likely a view of a spine, not the stomach, or the liver. Stomach ulcers, liver cirrhosis, and spinal cord pathology can be diagnosed with MRI, but the image in question shows a spinal view, not a gastrointestinal or abdominal view. Therefore, the only reasonable options left are nerve compression and cord pathology.
</think>

<answer>C</answer> **Groundtruth Answer: C**



Problem 4: What is the specific abnormality present in this image?

A) Gastritis, B) Arthritis, C) Appendicitis, D) Urolithiasis

MedVLM-R1 Output:

<think> The image presented is a transverse CT scan of the abdomen and pelvis. The presence of calculi (urines filled with stones or grit) in the pelvic organs is a consistent finding in urolithiasis. </think>

<answer>D</answer> **Groundtruth Answer: D**

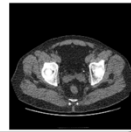


Fig. 2: Medical VQA examples of MedVLM-R1 on X-ray (1, 2), MRI (3) and CT (4).