Cognitive processing differences of experts and novices when correlating anatomy and cross sectional imaging

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RATIONALE

The ability to correlate anatomical knowledge and medical imaging is foundational to radiology. Experts do this well, but we have little understanding about how this occurs. Even more problematic, we don't know how novices assimilate this understanding. It is difficult to teach concepts of anatomy and imaging correlation when we don't know the degree of understanding of our novices.

METHOD AND MATERIALS

Ten radiologist experts (average age 47.4 years with 13.5 average years of experience; 9 males, 1 female) and 11 senior medical student novices (average age 27.4 years; 65 males, 6 females) performed a simulation localizing axial and sagittal computed tomography images within a human simulation torso. This study was IRB approved. Data was collected on image orientation, time, and correctness of localization. Participants were encouraged to do think alouds during the simulation sessions. The transcripts were coded and assessed for emerging themes. The simulation data was assessed with one-way and two-way ANOVAs. Chi-square analysis was preformed on the qualitative action codes. Significance was assessed at $p<0.05$.

RESULTS

In support of the literature, experts are significantly faster at making decisions on medical imaging than novices ($p<0.001$). Quickness is only one factor. When localizing an image in the body, experts rely on organ substructures ($p<0.0001$) whereas novices weigh heavily on size or amount of an organ in the image ($p<0.001$). Experts are more likely to use the correct terminology ($p<0.001$), whereas novices are more likely to misinterpret the anatomy ($p=0.002$) and use non-anatomic descriptive cues (color, blobs, patterns) to describe what they are viewing ($p=0.004$). Experts notice patterns on medical imaging not common to novices. When performing fine-tuning adjustments during a localization, experts isolate a structure with a narrow zone of change ($p<0.001$), compared to novices who use the shape or size of an organ ($p<0.001$) or trial and error methods ($p<0.001$) when performing the same tasks.

CONCLUSION

There are differences in the cognitive processing of experts and novices with respect to meaningful patterns, organized content knowledge and the flexibility of retrieval. Presented are some novice-expert differences in image processing. This study investigated extremes, opening an opportunity to investigate the sequential knowledge of residents, and where educators can help intervene in this learning process.