MP47-14: Objective Metrics of High Cognitive Workload during Robotic Urologic Surgery: A Pilot Study

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Rationale and Findings

- High cognitive workload adversely affects surgeon performance.

- Technology which automatically detects cognitive workload could lead to better training and fewer clinical errors.

- Electroencephalography (EEG) is one technology to measure cognitive workload.

- Alpha bandpower is indirectly related to cognitive workload, while theta bandpower is directly related.

Objective: To determine if a surgeon's cognitive workload can be accurately predicted by EEG during robotic-assisted urologic surgery.

Conclusion: By comparing high- and low-risk steps of the procedures, EEG can be used to assess the surgeon’s cognitive workload.
Methods and Results

- A 14-channel EEG was worn by four surgeons (2 experts, 2 trainees) during 6 robotic partial nephrectomies and 2 robotic prostatectomies.
- The procedures were divided into high and low risk segments.
- The expert surgeon performed the critical portions of the procedures.
- A total of 35 segments were analyzed.
- For all EEG leads, both alpha and theta bandpower were consistent with significantly greater workload during the critical portions of the procedures (Figure 1).
- For all EEG leads, both alpha and theta bandpower were consistent with significantly greater workload by the expert surgeon compared to the trainee (Figure 2).

**Figure 1.** Boxplots comparing brain activity before, during, and after critical segments for the (a) alpha bandpower and (b) theta bandpower.

**Figure 2.** Boxplots comparing brain activity between expert and trainee surgeons for (a) alpha bandpower and (b) theta bandpower.