A dissection gesture classification and initial validation on robotic renal hilum preparation

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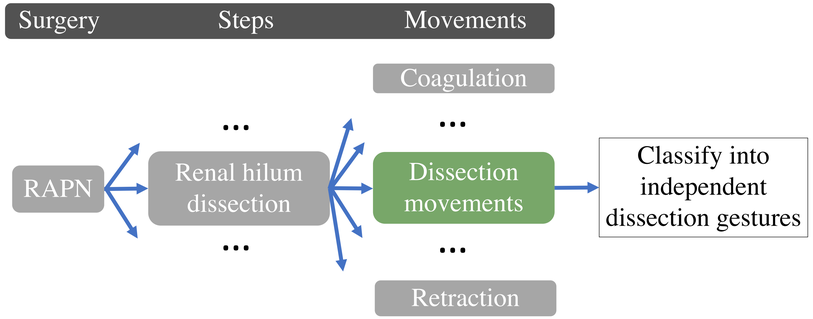
Introductions and objectives

- The deconstruction of surgery into a semantic vocabulary yields an effective tool for surgical education.
- We previously developed a suturing gesture classification system and demonstrated its value in surgical education (Chen J et al., JU, 2018).
- Herein, we aim to develop a novel dissection gesture classification system and utilize it to identify dissection pattern differences between expert surgeons and novices.

Methods

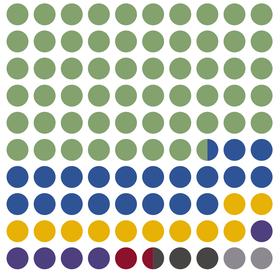
- Videos of robotic assisted partial nephrectomy (RAPN) renal hilum dissection step were segmented into discrete surgical movements by two annotators.
- All cases considered for this study were performed with a transperitoneal approach where surgeons operated with monopolar scissors in their dominant hand.

A brief introduction video of dissection gestures



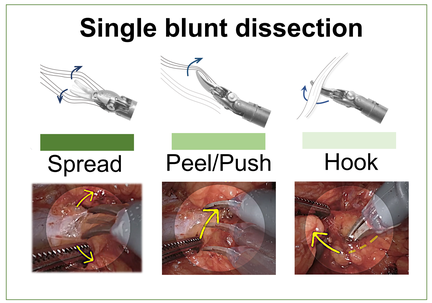
Results

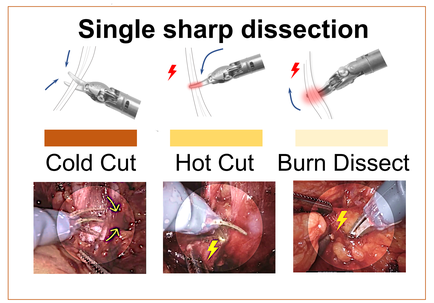
- 9,819 surgical movements were identified across the 40 renal hilar dissections

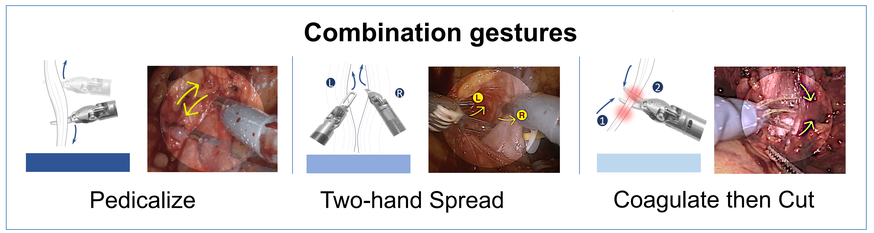


Movement Category	Number	%
Dissection	5667	57.7
Retraction	1902	19.4
Camera movement	1173	12.0
Assistant motion	475	4.8
Coagulation	163	1.7
Ineffective movement	229	2.3
Idle times	210	2.1

- Nine independent robotic dissection gestures were identified

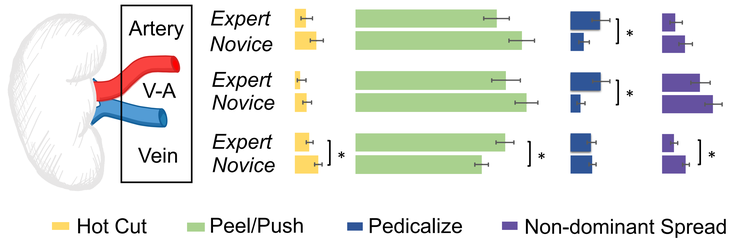






Results

- **Efficiency was compared between experts (≥100 robotic surgery experience) and novices (<100 robotic surgery experience).** Experts completed five of nine dissection gestures more efficiently than novices, including *spread*, *hook*, *cold cut*, *burn dissect*, and *two-hand spread* ($p \leq 0.033$)
- **Gestures were compared in different anatomical locations.** Around the renal vein, experts used more *peel/push*, but less *hot cut* and *non-dominant hand spread* ($p<0.001$). Around the renal artery and V-A, experts used more *pedicalize* than novices ($p<0.001$).



Bar lengths represent an experience group's percent usage of a specific gesture amongst all dissection maneuvers within a given anatomical location. Asterisks highlight significant differences between experts and novices. The error bar represents 95% CI of the proportion. V-A, between the renal vein and artery.

Conclusions

- Using this novel dissection gesture classification system, key differences in dissection patterns can be found between experts/novices.
- This comprehensive classification of dissection gestures may be broadly applied to streamline surgical education.