Developing a Robotic Surgery Curriculum: Construct Validity Analysis of a Novel Virtual Reality Training Platform

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Problem



The utilization of robotic-assisted surgery (RAS) has dramatically increased, demanding the implementation of standardized training curricula.

Objective

To refine our introductory RAS skills curriculum by determining proficiency thresholds based on expert performance for each task and by performing a construct validity analysis to determine if the VR task thresholds effectively differentiate novices from experts.

Methods



Two hepatobiliary surgical oncologists with expertise in complex robotic surgery each performed 5 repetitions of 20 VR tasks and 3 inanimate tasks.

A mean modified expert score was compared to the mean first attempt score from 41 residents who completed the VR curriculum.

Results

Table 1: Mean resident first attempt score and modified mean expert score for each task. Red arrows indicate tasks that did not demonstrate construct validity.

	Task	Mean Resident First Attempt Score	Modified Mean Expert Score	*p*
VR Tasks	Clutch	77.19	62.15	**0.783** ←
	Camera 0	63.93	97.57	0.012
	Wrist Articulation 1	70.62	92.5	0.005
	Wrist Articulation 2	77.36	96.5	<0.001
	Energy Pedals 2	89.00	97.75	**0.300** ←
	4th Arm Cutting	96.25	100	0.021
	Sea Spikes 1	78.31	95.25	<0.001
	Sea Spikes 2	70.55	91.29	<0.001
	Three Arm Relay 1	70.69	99.71	0.001
	Three Arm Relay 3	19.29	92.75	<0.001
	30-Degree Scope Swap (Xi)	69.76	96.43	<0.001
	Ring Rollercoaster 2	20.74	89.43	<0.001
	Ring Rollercoaster 4	44.88	62.00	**0.227** ←
	Posterior Needle Driving ATW	81.05	97.88	0.001
	Anterior Needle Driving ATW	89.75	94.12	**0.089** ←
	ATW Needle Driving	9.10	66.12	<0.001
	Big Dipper Needle Driving	46.24	86.50	<0.001
	Knot Tying	43.43	95.62	<0.001
	Puzzle Piece Dissection	69.44	84.62	**0.058** ←
	Vessel Energy Dissection	43.76	81.50	0.011
Inanimate Tasks	Simple Suture		527.57	
	Pattern Cut		170.13	
	Continuous Suture		399.63	

Expert performance benchmarks were established for 20 VR tasks and 3 inanimate tasks.

Expert scores were not significantly different from resident scores on 5 VR tasks.

15 VR tasks demonstrated construct validity.

Conclusion

Our study defined an introductory training curriculum of VR and inanimate tasks for general surgery residents that has demonstrated content and construct validity for developing robotic surgical proficiency.

