

The utility of endovascular simulation to improve technical performance and stimulate continued interest of preclinical medical students in vascular surgery

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Purpose: New training paradigms in vascular surgery allow for early specialization out of medical school. Surgical simulation has emerged as an educational tool for trainees to practice procedures in a controlled environment allowing interested medical students to perform procedures without compromising patient safety. The purpose of this study is to assess the ability of a simulation-based curriculum to improve the technical performance and interest level of medical students in vascular surgery.

Methods: Twenty-four medical students enrolled in a vascular surgery elective course. Students completed a survey of their interests and performed a renal stent procedure on an endovascular simulator (pre-test). The curriculum consisted of didactic teaching and weekly mentored simulator sessions and concluded with a final renal stent procedure on the simulator (post-test). Objective procedural measures were determined during the pre- and post-test by the simulator, and subjective performance was graded by expert observers utilizing a structured global assessment scale. After the course, the students were surveyed as to their opinions about vascular surgery as a career option. Finally, one year after the course, all students were again surveyed to determine continued interest in vascular surgery.

Results: The objective and subjective criteria measured on the simulator and structured global assessment scale are summarized in the table. Significant improvements from pre- to post-test were demonstrated in performer technical skill, patient safety measures, and structured global assessments. Before beginning the course, 9.5% of the students expressed high interest in vascular surgery, and after completing the course 71% were seriously considering vascular surgery as a career option ($p=.0001$). More than 95% of the students responded that endovascular simulation increased their knowledge and interest in vascular surgery. In the 1-year follow-up survey, 30% had already entered their clinical years. 70% of the students were still considering vascular surgery, while several other career options were still popular including the surgical subspecialties (80%), interventional cardiology (55%), and interventional radiology (50%). Most respondents indicated the major reasons for continued interest in vascular surgery were the ability to practice endovascular procedures on the simulator (95%) and mentorship from vascular surgery faculty (80%).

Conclusions: The use of high-fidelity endovascular simulation within an introductory vascular surgery course improves medical student performance with respect to technical skill, patient safety parameters, and global performance assessment. Mentored exposure to endovascular procedures on the simulator positively impacts long-term medical student attitudes towards vascular surgery. Simulator-based courses may have the potential to be an important component in the assessment and recruitment of medical students for future surgical training programs.

Criteria Measured (n=24 students)		Pre-Test Mean	Post-Test Mean	P-Value
Objective: Technical skill	Procedure Time (min)	22.1	15.0	<0.001
	Time to Aortogram (min)	8.7	3.1	<0.001
	Time to Intervention (min)	15.0	8.7	<0.001
	% Residual Stenosis	26%	17%	0.03
	% Lesion Covered	77%	89%	0.03
Objective: Patient Safety	Fluoroscopy Time (min)	10.4	8.3	0.02
	Contrast Injected (ml)	34.4	27.6	0.08
	ACT at Intervention (sec)	189	312	<0.001
Subjective: Global Assessment Scale	Total Score	1.80	3.89	<0.001
	Angiogram Score (1-5)	1.76	4.00	<0.001
	Wire Access Score (1-5)	1.83	3.82	<0.001
	Intervention Score (1-5)	1.82	3.83	<0.001