

Retention of fundamentals of laparoscopic surgery (FLS) proficiency with a biannual mandatory training session

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Received: 3 April 2014 / Accepted: 7 July 2014 / Published online: 15 August 2014
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Abstract

Background The fundamentals of laparoscopic surgery (FLS) program was developed by the Society of American Gastrointestinal and Endoscopic Surgeons (SAGES) in 1997 with the goal of teaching surgeons the fundamental knowledge, judgment, and technical skills specific to laparoscopic surgery (Peters et al., *Surgery JH* 135:21–27, 2004; Soper et al., *Bull Am College Surg NJ* 93:30–32, 2008). This single academic institution observational study aimed to assess the effectiveness of a biannual FLS training curriculum on Post-Graduate Year [PGY] 1–5 proficiency levels, with a focus on one FLS task (PEG transfer). Previous studies have shown that obtaining expert FLS proficiency correlates with retaining proficiency in the future (Castellvi et al., *Surgery* 146:387–393, 2009).

Methods PGY 1–5 residents ($n = 28$) at an academic general surgery residency program performed two timed PEG transfer tasks biannually. Participants were monitored by FLS certified examiners and standard FLS rules applied. Residents were expected to meet or exceed standards set by

SAGES and FLS in consecutive timed PEG transfer trials (proficiency: <48 s).

Results Twenty-eight residents participated (PGY 1–5). Participants showed proficiency if they completed the PEG transfer task in less than 48 s on two consecutive trials. None of the PGY 1 or PGY 2 residents completed two consecutive trials within the stated proficiency time, while the majority of the PGY 3–5 residents showed proficiency in the PEG transfer task.

Conclusion A biannual training session for FLS retains expert proficiency by PGY levels 4–5. Previous reports from our institution demonstrated that 95 % of the residents did not practice this task between mandatory biannual sessions. This suggests that, in combination with standard residency training, biannual FLS sessions confer retained expert skills by PGY 4–5. As the FLS exam is generally taken by PGY 4 and 5 residents and is required for board certification, general surgery residents that participate in biannual training sessions will likely retain expert proficiency and achieve FLS certification.

Presented at the SAGES 2014 Annual Meeting, April 2–5, 2014, Salt Lake City, Utah.

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Keywords Fundamentals of laparoscopic surgery (FLS) ·
Surgical resident · PEG transfer · Skills retention

The fundamentals of laparoscopic surgery (FLS) program was developed by the Society of American Gastrointestinal and Endoscopic Surgeons (SAGES) in 1997 [1]. The goal of FLS is to teach and certify surgeons in the basic knowledge, judgment, and technical skill specific to laparoscopic surgery [2]. As minimally invasive surgery (MIS) continues to expand in the surgical community, a greater emphasis has been placed on laparoscopic skills training during surgical residency. MIS offers a variety of benefits to patients and the healthcare system alike, when compared

to traditional, more invasive, surgical techniques [3]. These benefits include less postoperative pain, shorter length of hospital stay, faster return to normal work and activities, and improved esthetic outcome. For these reasons, the demand for MIS is ever increasing [4].

Surgical residency programs are quickly adapting, and resident exposure to laparoscopic surgery has become a more predominate aspect of training. Furthermore, surgical residents are seeking volume and variety of laparoscopic cases which obligate laparoscopic-specific simulation and practice within the skills lab, in addition to hands-on training in the operating room. The FLS program has contributed to residency training with a comprehensive education module and hands-on skills training [5]. As of 2008, FLS was mandated as a pre-requisite of the American Board of Surgery Qualifying Examination.

This single center academic institution observational study aimed to assess the effectiveness of a biannual FLS training curriculum on post-graduate year (PGY) 1-5 proficiency levels, with a focus initially on the PEG transfer. This task is intended to measure basic technical ability such as precision and bimanual dexterity [5, 6]. Importantly, prior studies have demonstrated that basic skills, such as the PEG transfer, result in skill acquisition applicable to more complex intra-operative laparoscopic tasks [4, 5]. Furthermore, previous studies have shown that obtaining expert FLS proficiency correlates with retaining this proficiency in the future [3, 7].

The ability to attain proficiency with biannual FLS skills sessions, in combination with general surgery residency training, is of increasing importance now that work hour restrictions are enforced strictly [5]. Specifically, our data address the ability of biannual training sessions to teach or simply assess FLS skill proficiency through residency, with focus on gaining published expert proficiencies, which have been shown to predict passing the FLS exam [8, 9]. Ideally, this occurs by PGY years 4-5, prior to FLS certification.

Materials and methods

PGY 1-5 residents ($n = 28$) at an academic general surgery residency program performed a 1 h PEG transfer task training session biannually, 6 months apart. Residents were asked to complete their time trial without a practice or “warm up” attempt. Each resident presented to laparoscopic skills lab, and under the observation of FLS certified examiners, they performed consecutive, timed PEG transfers. Per the FLS Manual Skills Written Instructions and Performance Guidelines, the PEG transfer exercise requires six objects to be lifted with a grasper/dissector by the participant’s non-dominant hand (Fig. 1, Image 1), followed by transfer of the object midair to the dominant hand (Fig. 1, Image 2), which then places each object on a PEG on the opposite side of the board (Fig. 1, Image 3). Once

Fig. 1 PEG transfer task

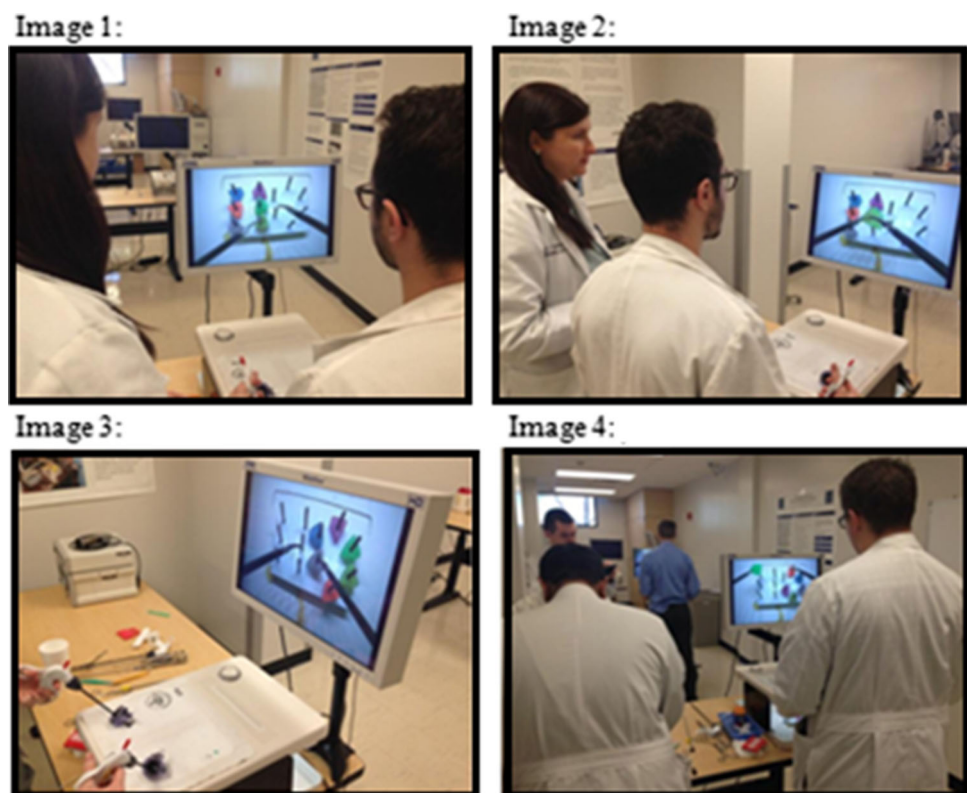


Table 1 Individual PEG transfer times during biannual sessions

Time (in seconds) to complete the PEG transfer during two consecutive attempts biannually:				
PGY	Trial 1a	Trial 1b	Trial 2a	Trial 2b
1-1	79	58	55	55
1-2	78	85	81	75
1-3	66	55	60	68
1-4	80	79	67	66
1-5	65	53	60	62
1-6	73	60	57	56
1-7	80	65	54	61
1-8	77	58	60	55
2-1	56	53	52	50
2-2	90	67	93	72
2-3	74	49	60	49
2-4	67	58	54	45
2-5	64	62	54	54
2-6	61	51	51	52
3-1	65	45	47	45
3-2	75	84	62	51
3-3	44	44	49	40
3-4	47	47	48	45
3-5	53	49	45	43
3-6	61	53	48	51
4-1	42	40	38	38
4-2	54	55	56	43
4-3	48	46	47	48
4-4	37	41	31	34
5-1	38	38	37	36
5-2	33	32	33	34
5-3	48	40	35	35
5-4	36	35	37	48

Table 2 Average PEG transfer time (in seconds) for Trial 1 compared to Trial 2 organized by post-grad year

PCY	Trial 1	Trial 2	<i>p</i> value
1	69.4	62.3	0.039
2	62.7	57.2	0.283
3	55.6	47.8	0.072
4	45.4	41.9	0.364
5	37.5	36.9	0.801

all six objects have been transferred, the process is reversed (Fig. 1, Image 4). Timing for this task begins when the first object is touched, and ends upon release of the last object. A time penalty is added for any object dropped out of the field of view or any object dropped outside of reach. This exercise tests hand-eye coordination, ambidexterity, and depth perception [3, 8]. Residents were expected to meet or

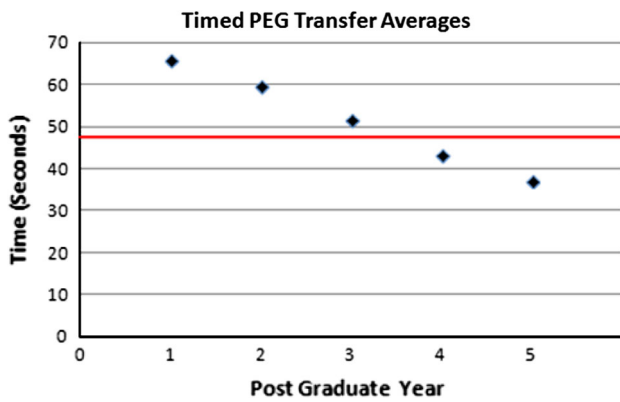
exceed standards set by SAGES and FLS in consecutive timed PEG transfer trials (proficiency time: <48 s). All twenty-eight residents performed their initial trials for the PEG transfer near the beginning of the 2013–2014 academic year. They then performed a second session of PEG transfer time trials approximately 6 months later. Times were recorded and organized by post-graduate year. The time cutoff, 48 s, was used to determine proficiency, with a 300 s time limit.

Results

Twenty-eight residents (17 male, 11 female) participated in the study, ranging from PGY 1-5 (Table 1). Participants showed proficiency if they could complete the PEG transfer task in less than 48 s on two consecutive trials. None of the PGY 1 or PGY 2 residents completed two consecutive trials within the stated proficiency time during either of the biannual sessions, while the majority of PGY 4-5 residents showed proficiency in the PEG transfer task (Table 2). Two of the six, or 33 %, of the PGY 3 residents completed all four of the PEG transfer trials at a proficient level. Three of the four, or 75 %, of the PGY 4 residents completed all four of the PEG transfer trials at a proficient level. Four of the four, or 100 %, of the PGY 5 residents completed all four of the PEG transfer trials at a proficient level.

When averaged, each subsequent post-graduate year did better than the year before (Graph. 1). Furthermore, PGY 1 through 5 residents tended toward faster PEG transfer times during the second biannual session as compared to the first. To analyze the data, a Student's *t* test was used. Trials 1a and 1b were compared to Trials 2a and 2b, therefore looking at improvement between the first biannual session of the year and the second (Graph. 2). When comparing all years, there was statistical significance between the trial times at the start of the year and at mid-year ($p = 0.04$). Specifically, junior residents (PGY 1 and 2) made a statistically significant improvement in their PEG transfer times from the first session to the second ($p = 0.03$). A significant difference was not seen in the PGY 3-5 group between biannual sessions ($p = 0.09$).

When the data were analyzed for each individual year, only the PGY 1 residents were found to make significant improvement from the first session to the second (PGY1- $p = 0.04$), while PGY 2-5 did not show statistically significant improvement at the second biannual session as compared to the first (PGY 2 $p = 0.28$; PGY 3 $p = 0.06$; PGY 4 $p = 0.36$; PGY 5 $p = 0.80$). Of note, no participant of any PGY level went over the time limit of 300 s.



Graph 1 PEG transfer times by post-grad year

Discussion

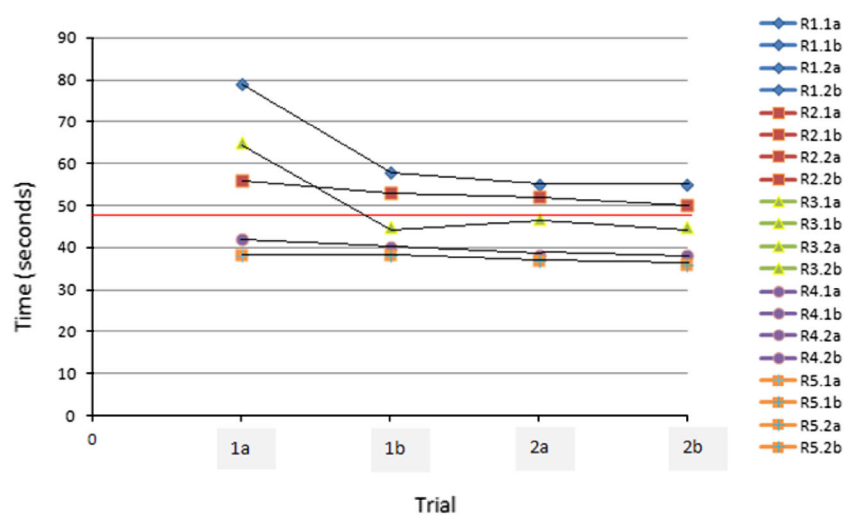
FLS certification is now required by the American Board of Surgery [4]. Not only is the FLS program CME accredited, but also the content has been endorsed by the American College of Surgeons (ACS). Biannual FLS skills assessment sessions, in combination with general surgery residency training, are adequate for the majority of residents to reach proficiency of their laparoscopic skills by the 3rd year of residency, with nearly all residents attaining expert proficiency by their 4th year of residency. Prior studies and research have demonstrated that attaining proficiency results in maintenance of those skills in the future, it can be expected that those who reach proficiency will stay proficient throughout their residency and beyond [9, 10]. Additionally, previous studies have demonstrated that performance in simulations correlates significantly with performance in vivo [11]. In 2000, Scott et al. [12] randomized 27 PGY 2-3 residents to a simulator practice group or a control group in a well-designed study. This

demonstrated that improvements in OR performance was significantly greater in the trained group, reinforcing the importance of laparoscopic simulation training during surgical residency.

Our study demonstrated significantly improved PEG transfer times in junior surgery residents between sessions at the start of the year and those approximately 6 months later. It did not show a significant improvement in PEG transfer times for senior residents between biannual sessions. The inability of PGY 1-2 residents to perform to expert proficiency is not surprising, nor is the acquisition of expert proficiency by the PGY 4–5 years. This suggests this manual task has construct validity, specific between junior and senior training levels. It can be concluded that a biannual assessment session for FLS demonstrates expert proficiency often by PGY 3 and more certainly by PGY 4 and 5. Previous reports from our institution demonstrated that 95 % of the residents did not practice this task between mandatory biannual sessions [10]. Of note, a single FLS task was explored in this study, and further investigation is needed to determine if similar results would apply to all five FLS skills (transfer, cutting, ligating loop, intracorporeal and extracorporeal suturing). In addition, the written portion of the FLS certification requirement was not studied and should be included in future comprehensive studies of the training necessary to achieve FLS proficiency. The results of this study suggest that general surgery residents, assessed through biannual training sessions, along with standard general surgery residency training, will retain expert proficiency in the PEG transfer task by completion of training without intervening task practice.

Disclosures Drs. Shawn Tsuda, Lindsay Wenger, and Cory Richardson have no conflicts of interest or financial ties to disclose.

Graph 2 PEG transfer for two consecutive biannual time trials organized by post-graduate year



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