A Randomized Controlled Trial to Assess the Effects of Competition on the Development of Laparoscopic Surgical Skills

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BACKGROUND: Serious games have demonstrated efficacy in improving participation in surgical training activities, but studies have not yet demonstrated the effect of serious gaming on performance. This study investigated whether competitive training (CT) affects laparoscopic surgical performance.

METHODS: A total of 20 novices were recruited, and 18 (2 dropouts) were randomized into control or CT groups to perform 10 virtual reality laparoscopic cholecystectomies (LCs). Competitiveness of each participant was assessed. The CT group members were informed they were competing to outperform one another for a prize; performance ranking was shown before each session. The control group did not compete. Performance was assessed on time, movements, and instrument path length. Quality of performance was assessed with a global rating scale score.

RESULTS: There were no significant intergroup differences in baseline skill or measured competitiveness. Time and global rating scale score, at final LC, were not significantly different between groups; however, the CT group was significantly more dexterous than control and had significantly lower variance in number of movements and instrument path length at the final LC ($p = 0.019$). Contentiousness was inversely related to time in the CT group.

CONCLUSION: This was the first randomized controlled trial to investigate if CT can enhance performance in laparoscopic surgery. CT may lead to improved dexterity in laparoscopic surgery but yields otherwise similar performance to that of standard training in novices. Competition may have different effects on novices vs experienced surgeons, and subsequent research should investigate CT in experienced surgeons as well. (J Surg 72:1077-1084. © 2015 Association of Program Directors in Surgery. Published by Elsevier Inc. All rights reserved.)

KEY WORDS: surgical education, virtual reality simulation, student education, competitive training, minimally invasive

COMPETENCIES: Patient Care, Medical Knowledge, Practice-Based Learning and Improvement

INTRODUCTION

Surgical training programs are working to adapt their curricula to improve the efficiency of surgical education by augmenting didactic training and intraoperative education with simulation to remain in compliance with Accreditation Council for Graduate Medical Education (ACGME) requirements.[1] Many questions remain, however, about how best to implement simulation into curricula to maximize the efficiency of training.

Although prior comparisons to aviation have yielded a fair amount of knowledge regarding the utility of simulation,[2]

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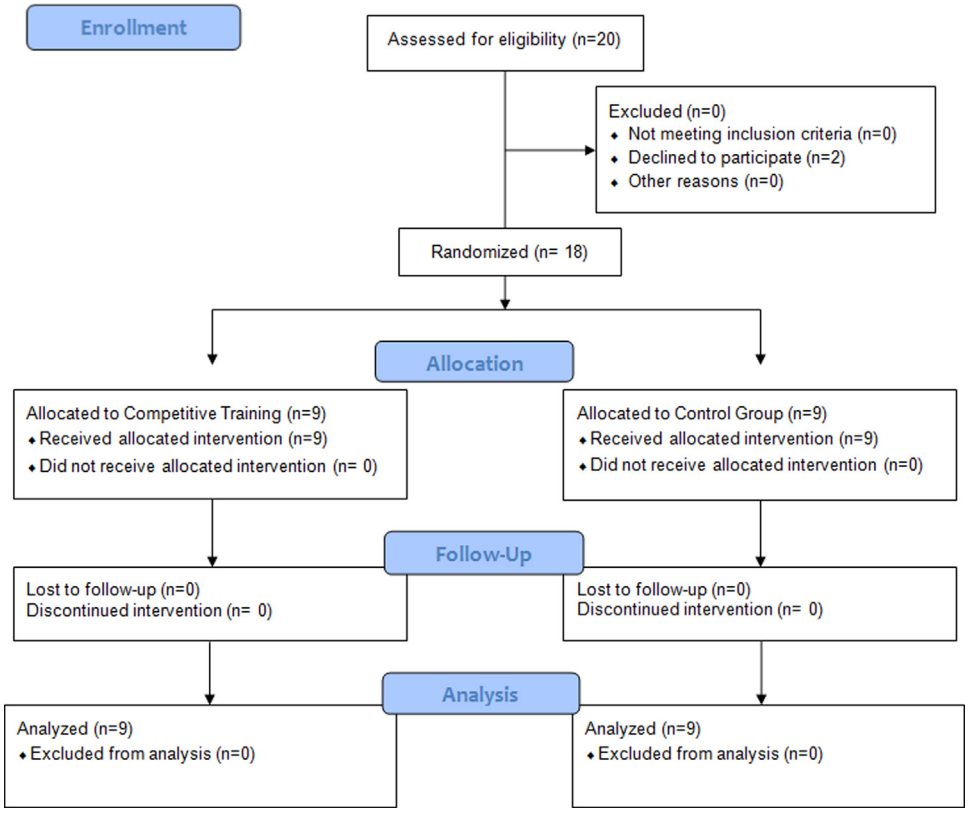

FIGURE 1. Flow chart of study protocol with recruited subjects and dropouts.

other high-performance industries, such as sports, may also provide valuable insight into potential training strategies to elicit superior performance. Some pedagogical techniques identified in sports have already been investigated in surgery, including warm-up,[3] mental practice,[4] and deliberate practice.[5,6] Competition has been found to lead to improved performance in sports, including golf, weight lifting, and basketball.[7-9] Gamification, the use of game mechanics such as competition, has been successfully used to improve motivation to participate in surgical simulation training and to teach and assess clinical decision making[10,11]; however, no studies have investigated the effects of competition on technical skills performance in a randomized, controlled manner.

We hypothesized that competition would lead to improved performance in trainees. This study investigated the effects of competition on performance during successive virtual reality (VR) laparoscopic cholecystectomy (LC) cases.

METHODS

Participant Selection

Owing to the educational nature of the study, this protocol was exempted from further ethics review. Informed consent was obtained from all participants, and participants were informed that their participation, or lack thereof, would in no way affect their medical training or medical care they might receive. Medical students from London hospitals with an interest in surgery were invited to participate in the study. Based on power analysis and cost constraints, 20 ($n = 20$) medical students were recruited. All trainees had limited surgical experience (performed 0 but observed >1 LC in the operating room). All participants were offered a certificate of completion in a basic laparoscopic skills course if they completed all sessions of the study. At recruitment, participants were randomized into 1 of 2 equal groups—competitive training (CT) group or control group—using a random number generator (STATA, College Station, TX) (Fig. 1).

Baseline Assessment

Each participant underwent a validated baseline skills assessment on the LapMentor VR (Simbionix; Cleveland, OH) laparoscopic simulator on Basic Skills tasks 5 and 6. For Basic Skills task 5, time to completion was assessed. For Basic Skills task 6, time to completion and number of movements were recorded as these metrics have been shown to be construct valid.[12]

Participants were also asked to complete the Revised Competitiveness Index, a psychometric questionnaire designed to assess individuals' trait of competitiveness along 2 domains—enjoyment of competition and contentiousness (desire to outperform others).[13] Each domain is tested on its