EDUCATION

Does mental imagery prior to cystoscopy make a difference? A randomized controlled trial

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OBJECTIVE: We sought to determine whether mental imagery improves surgical performance of residents novice to cystoscopy.

STUDY DESIGN: We performed a multicenter randomized controlled trial. Residents who had performed ≤ 3 cystoscopies were randomized to preoperative mental imagery sessions or reading a book chapter describing cystoscopy. The primary outcome was comparison of groups' surgical performance scores. Secondary outcomes were measurements of operative times and resident ratings of helpfulness of their preparation. Scores were compared using 2-factor analysis of variance.

RESULTS: In all, 68 residents were randomized; 33 to imagery and 35 to control groups. Groups did not differ in age, cystoscopic experience, residency level, or sex. The imagery group's surgical assessment scores were 15.9% higher than controls ($P = .03$). Operative times did not differ between groups. Imagery residents rated imagery preparation as more helpful than controls ($P < .0001$).

CONCLUSION: Residents considered mental imagery to be a more useful preoperative preparation. The mental imagery group's surgical performance was superior to controls.

Key words: cystoscopy, educational research, mental imagery, preoperative preparation

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Evolving demands on surgical training necessitate development of educational techniques that rapidly enhance surgical performance. Traditionally, surgical education has been based on a model of graded responsibility under a mentor. Trainees have been apprentices who learned from repetition. This apprenticeship model is under siege because of decreased resident work hours, ethical concerns regarding "practicing" skills on patients, and limitation in numbers of experienced mentors.[1] Additionally, current resident work hour limitations have raised concerns that surgical volume per resident will decrease.[2] Concerns are not limited to physicians in training. Equally important, proliferation of new procedures will make even experienced surgeons novice sometime during their careers. Accordingly, it will be necessary to develop innovative methods that improve skill attainment not only for residents but for all practitioners.

Mental imagery has successfully improved skills and enhanced performance in athletics.[3,4] Strictly defined, mental imagery is "the symbolic rehearsal of a physical activity in the absence of any gross muscular movements."[4] It has been hypothesized that mental imagery produces cognitive blueprints for movement patterns and mental rehearsal of these blueprints allows movements to become automatic.[4] Surgery and athletics share similar characteristics. Both require advanced motor skills and the intellect to adapt to new situations.

More recent advances in cognitive psychology support mental imagery's potential use in surgical education.[5,6] For example, dual coding theory distinguishes between verbal and nonverbal cognition. Researchers believe that coupling of verbal and nonverbal encoding improves learning.[5-7] Accordingly, mental imagery practice, a combination of verbal and nonverbal cognition, could be a superior educational technique for surgical training compared to textbook reading, primarily a verbal activity. Regardless of mechanism, mental imagery

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practice is particularly useful in tasks with large cognitive components.[3] Thus, mental imagery may be well suited to improving surgical performance.[1,8] Despite potential advantages of mental imagery practice prior to surgery, study of its use in surgical training is still in its formative stages.[1,8-10] Mental imagery has been found to be an effective tool to teach medical students cricothyrotomy in a simulated situation as well as animal suturing in an operating department suite.[9,10] Recently, consistent with the dual coding theory of cognition, mental imagery was also found to be a more effective tool than textbook study among medical students.[7]

We aimed to evaluate whether mental imagery improved residents' surgical performance in actual clinical practice. Our hypothesis was that mental imagery improved surgical performance in the operating room. Our specific goal was to determine whether formal mental imagery practice before cystoscopy improved surgical performance of gynecology residents novice to cystoscopy. For our primary outcome, we compared performance ratings between residents who practiced mental imagery prior to cystoscopy to those who were randomized to reading a textbook. Based on the dual coding theory, mental imagery practice would be superior to textbook study. For secondary outcomes, we compared time for cystoscopy performance and compared resident ratings of helpfulness of their preoperative preparations.

Materials and Methods

We conducted a multicenter randomized controlled trial. Subjects were recruited from 6 academic centers. Gynecology residents who had observed at least 1 cystoscopy and performed ≤ 3 cystoscopies were eligible to participate regardless of house officer level. We required residents to have observed at least 1 cystoscopy before performing cystoscopy because this was standard at most of the institutions. The ≤ 3 cystoscopy cut-off point was decided on by consensus of the investigators. Based on their experience as educators, they agreed that this was a conservative threshold to determine novice status. The primary investigators at each site obtained local institutional review board approval. All subjects gave written informed consent. Evaluations occurred during resident rotations on gynecology services at their respective institutions.

We compared performance ratings between residents who practiced mental imagery prior to cystoscopy to those who did not. Residents were assigned to groups after they gave informed consent. Study participants were assigned to either mental imagery (imagery group) or instructed to read the same cystoscopy chapter in a specific textbook (control group).[11] A random numbers table generated assignments using block randomization groups of 4. A research nurse otherwise uninvolved with the study, ensured the allocation sequence was concealed and placed group assignments in sealed, opaque envelopes.

Residents' age, sex, and level of training were recorded. Although inclusion criteria included performance of ≤ 3 cystoscopies, all residents were asked to record the number of cystoscopies they had performed prior to entering the study. Each resident was also asked to record whether they had completed their assigned preoperative preparation. Intention-to-treat analysis was performed initially; results were analyzed on all randomized residents regardless of whether or not they complied with their preoperative assignment.

Mental imagery sessions were administered by gynecology faculty (imagery educators) at each site. To standardize imagery sessions, a digital video disc (DVD)-recorded template of mental imagery sessions performed at the coordinating site was sent to all mental imagery educators. The DVD served as a template on which mental imagery educators at the different institutions were to fashion their imagery sessions. The DVD recorded a resident from the coordinating site using mental imagery prior to performing cystoscopy. The resident described assembly and insertion of the cystoscope, identification of bladder landmarks, systematic survey of bladder quadrants, identification of potential abnormalities, and urethral inspection. The DVD was not shown to the study subjects since its purpose was to standardize imagery sessions for mental imagery educators.

Mental imagery educators, all gynecology faculty members, individually met with subjects randomized to mental imagery preparation within 24-48 hours of each of the scheduled cystoscopies. Residents rehearsed performance of the procedure with the educators during 1-on-1 sessions. Residents were instructed to envision performing the procedure and described cystoscopy performance to the educator. Educators required residents to describe all the components of the cystoscopy; assembly and insertion of the cystoscope, identification of bladder landmark, and 4-quadrant survey of the bladder. The study protocol specified that imagery sessions last $<$ 20 minutes. Imagery educators were aware of the randomization assignments.

The control group was instructed to individually read the same chapter in a standard text describing cystoscopy within 24-48 hours of each of the 2 planned cystoscopies.[11] The chapters included 8 illustrations or photographs of cystoscopes/cystoscopies and 10 pages of text. Investigators estimated reading this chapter would take a similar amount of time as imagery sessions. Postoperatively, residents were asked whether or not they had performed their assigned preoperative assignments.

Attending physicians or urogynecology fellows who had done $>$ 50 cystoscopies evaluated residents' performance. Cystoscopy evaluators were blinded to randomization and were different individuals than the imagery educators. Prior to evaluating resident cystoscopies, evaluators viewed a DVD of 3 mock cystoscopies portraying novice, intermediate, and expert cystoscopies. These mock cystoscopies were performed on a pelvic model by one of the investigators, videotaped, and sent to each site. Evaluators graded each cystoscopy. Intraclass correlation coefficients calculated on the mock cystoscopy scores equaled 0.78, indicative of high interrater reliability.

Residents were evaluated performing 2 separate cystoscopies on patients in the