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Review

Perioperative feedback in surgical training: A systematic review

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ABSTRACT

Background: Changes in surgical training have raised concerns about residents' operative exposure and preparedness for independent practice. One way of addressing this concern is by optimizing teaching and feedback in the operating room (OR). The objective of this study was to perform a systematic review on perioperative teaching and feedback.

Methods: A systematic literature search identified articles from 1994 to 2014 that addressed teaching, feedback, guidance, or debriefing in the perioperative period. Data was extracted according to ENTREQ guidelines, and a qualitative analysis was performed.

Results: Thematic analysis of the 26 included studies identified four major topics. Observation of teaching behaviors in the OR described current teaching practices. Identification of effective teaching strategies analyzed teaching behaviors, differentiating positive and negative teaching strategies. Perceptions of teaching behaviors described resident and attending satisfaction with teaching in the OR. Finally models for delivering structured feedback cited examples of feedback strategies and measured their effectiveness.

Conclusions: This study provides an overview of perioperative teaching and feedback for surgical trainees and identifies a need for improved quality and quantity of structured feedback.

1. Introduction

The operating room (OR) is a unique learning environment, where trainees not only acquire technical skills, but also develop sound judgment and decision-making in order to become expert surgeons. Despite the fact that the crux of our work as surgeons takes place in the OR, little research has been done regarding the most effective ways to teach residents in this setting, and in particular how to provide effective feedback. Traditionally, surgical skill and knowledge are taught using an apprenticeship model,[1,2] where the surgical trainee acts as an apprentice to the expert surgeon, observing, learning, and eventually participating in cases. This is supplemented by a combination of didactic learning, to acquire the anatomical and procedural knowledge, as well as simulation, to acquire the technical skill set.

However, the landscape of surgical education is shifting, with new changes posing a threat to residents' educational experience in the OR. One major change is the implementation of work-hour restrictions.[3] Although the reported effect of this change on operative case volume has been variable,[4–7] there is concern that trainees do not have sufficient exposure to many standard general surgery procedures by the end of their residency training and are no longer provided opportunities for graduated responsibility that leads to autonomy.[8–10] While ultimately these concerns must be addressed on a greater scale, there are nonetheless steps that individual residency programs can take to optimize the learning experience for trainees. One way of doing this is to optimize teaching in the OR such that trainees can reap the greatest benefits from every clinical opportunity.

In order to improve teaching in the OR, we must first gain a better understanding of the type of learning interactions that occur in this setting, and the impact these have on trainees' acquisition of new knowledge and skills. This will subsequently allow us to determine best practices for teaching in the OR. The objective of

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this study is to systematically review the literature on intra- and perioperative teaching and feedback.

2. Methods

2.1. Search strategy

We performed a systematic review of the literature of all full text articles published in English or French between 1994 and 2014 according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA)[11] and Enhancing Transparency in Reporting the Synthesis of Qualitative Research (ENTREQ)[12] guidelines with the assistance of a health science librarian (T.L.). We searched six databases: Medline, Embase, PubMed, Education Resources Information Center, Web of Science, and Scopus using the following key words: "feedback, assessment, evaluation, competence/competency, decision making, technical skill, formative, intra-operative, and surgery/surgical". Reference lists and forward citations of selected articles were also hand searched individually to identify additional relevant studies not included in the database search. Studies were included if they addressed teaching, feedback, or debriefing for surgical residents that occurs in the immediate perioperative period (pre-, intra- or post-operative). We use the term "pre-operative teaching" to encompass all forms of teaching that occurs immediately prior to a case, such as briefing, reviewing the key points etc. "Intra-operative teaching" refers to teaching or feedback given during an operative case. "Post-operative teaching" refers to teaching taking place either in the immediate post-operative period or with a brief delay, but with direct reference to a specific case, such as resident feedback about their performance, discussion about the case, or debriefing.

Only original research studies were considered for inclusion. Studies pertaining to medical students, simulation, feedback outside of the operating room environment, or feedback aimed at summative assessment of resident performance were excluded. We also limited the included studies to those performed in high resource settings that reflect North American or European training environments. Each record was independently screened by two reviewers (K.M.M. and Y.W.) for eligibility and data extraction, and differences resolved by consensus adjudication. If no consensus could be obtained, a third independent author was consulted (M.C.V.).

2.2. Data extraction and synthesis

We presumed *a priori* that the majority of the studies that would be included in this systematic review would be qualitative, therefore we extracted data as per the ENTREQ guidelines.[12] Each study was reviewed for the following details: study population and sample size, timing of feedback (pre-, intra- or post-operative), and methodology used for feedback (interviews, analysis of video, direct observation, or use of a validated instrument). We then used thematic analysis as described by Thomas et al.[13] to develop analytical themes to offer a new interpretation of the overall literature. We anticipated that the studies identified in this systematic review would have very heterogeneous study designs and methodologies, therefore no attempt at quality assessment or quantitative synthesis was attempted.[14]

3. Results

The systematic search identified 1654 unique records, of which 90 underwent full-text review and 26 were included in the qualitative synthesis (Fig. 1). Thematic analysis of these 26 studies revealed four separate categories, into which the studies were classified: observation of teaching behaviors in the OR, identification of effective teaching strategies, resident and attending perceptions of teaching behaviors, and models for delivering structured feedback (Table 1). Objectives, methodology, and main results of each study are reported in Table 2.

3.1. Observation of teaching behaviors in the operating room

Six articles sought to characterize teaching and feedback interactions in the OR through observation of interactions between faculty surgeons and trainees. Three out of the six studies examined videotaped interactions and used verbal analysis techniques to characterize the type of teaching and feedback observed.[15–17] Blom et al. identified 4 types of feedback communication in the OR: commanding, explaining, questioning, and miscellaneous, of which the first two were the most commonly employed.[15] Roberts et al. defined surgeon-resident interactions based on purpose rather than content. The majority of interactions observed pertained to operative progress ("instrumental interactions") or "pure teaching interactions" aimed to shape the learner's knowledge or judgment. These were often prompted by resident error, which the authors refer to as "teachable moments."[17] Hu et al. analyzed descriptive narratives ("war stories") that were told in the OR and reported that although these interactions appeared superfluous or not directly related to the operative case, structuring teaching points in the form of stories may establish a connection with the learner and improve retention. The teaching points conveyed most commonly addressed operative technique, decision-making, error identification, or therapeutic options.[16]

Two studies used ethnographic observations to understand teaching behaviors in the OR.[18,19] Hauge et al. created a 26-item tool based on field observations, representing 4 categories of teaching behaviors: informing, questioning, responding, and setting tone.[19] Another study found that feedback and debriefing interactions were observed in only 46% of cases and were rarely solicited by the trainee. Furthermore, the quality of these interactions was poor, as they were often non-specific and pertained mainly to technical skills rather than judgment.[18]

Finally, Greenberg et al. aligned teaching interactions in the OR with core training competencies described by the Accreditation Council for Graduate Medical Education (ACGME) and found that the "Patient Care" competency was most frequently taught by faculty, at an average of 22 teaching events per case and 34% of total operative time; each of the five remaining competencies accounted for $\leq$ 1.2% of OR time, with similar results for trainees.[20]

3.2. Identification of effective teaching strategies

Six studies identified effective teaching behaviors from the perspective of attending surgeons and residents using surveys,[21] resident evaluations of attending staff,[22,23] interviews, and focus groups.[24–26]

One study examined the teaching philosophies of "master surgeons" to determine how they aligned with learning theories. The key concepts that these surgeons applied included: graduated responsibility, development of a mental set, deliberate practice, deconstruction of complex tasks, vertical transfer, and the application of general principles.[21] Attending surgeons also expressed their expectations of trainees; they felt that trainees should be prepared for cases, receptive to feedback, decisive but aware of their limitations, and actively involved, while still allowing the surgeon to be in control of the procedure.[25,26]

Trainees identified slightly different qualities of effective teaching behaviors than faculty. Based on results of resident