



How can surgeons facilitate resident intraoperative decision-making?



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ABSTRACT

Background: Cognitive skills such as decision-making are critical to developing operative autonomy. We explored resident decision-making using a recollection of specific examples, from the attending surgeon and resident, after laparoscopic cholecystectomy.

Methods: In a separate semi-structured interview, the attending and resident both answered five questions, regarding the resident's operative roles and decisions, ways the attending helped, times when the attending operated, and the effect of the relationship between attending and resident. Themes were extracted using inductive methods.

Results: Thirty interviews were completed after 15 cases. Facilitators of decision-making included dialogue, safe struggle, and appreciation for retraction. Aberrant case characteristics, anatomic uncertainties, and time pressures provided barriers. Attending-resident mismatches included descriptions of transitioning control to the attending.

Conclusions: Reciprocal dialogue, including concept-driven feedback, is helpful during intraoperative teaching. Unanticipated findings impede resident decision-making, and we describe differences in understanding transfers of operative control. Given these factors, we suggest that pre-operative discussions may be beneficial.

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1. Introduction

The operating room, a place where a significant portion of surgical resident training occurs, can be a challenging environment for teaching and learning. Important clinical goals such as patient safety must be balanced with resident education.^{1,2} In a 2012 survey of 998 surgery residents, 29% reported performing procedures only 26–50% of the time and 32% felt that they performed procedures 51–75% of the time.³ This indicates a compromise of intraoperative learning, which is critical for acquiring autonomy and operative competence.⁴

Financial and medicolegal concerns represent threats to resident involvement in surgical procedures. In 2016, the federal government paid over \$10 billion for hospital-based graduate medical education (GME), and although economic analyses demonstrate surgical GME net-profitability, the cost of surgical resident training is not negligible.^{5,6} Based on increased operative time alone, annual

cost estimates range from \$47,970 per resident in 1999, to \$324,073 per resident in 2013, or \$492,889 in 2016.^{7–9}

The most common procedure that general surgery residents perform is the laparoscopic cholecystectomy; a resident will perform this case a median of 80 times before graduation.¹⁰ Teaching surgeons are generally inaccurate in self-assessing the guidance they provide.¹¹ Even when objectively observed, in a study of laparoscopic cholecystectomies performed by residents, surgeons explicitly taught only half of the teaching points from a cognitive task analysis, with greater emphasis on technical skills than decision-making skills.¹² Since a negative correlation has been demonstrated between decision-making skills and technical errors, resident decision-making should be considered an important part of intraoperative teaching during surgical procedures.¹³ Nonetheless, a paucity of literature on intraoperative decision-making persists, especially among residents.

While resident surgical autonomy can be reliably evaluated, it is less clear how to facilitate it.^{14,15} Educational literature describes decision-making as a core component of the development of expertise,^{16,17} while surgical education literature has explored decision-making as a core non-technical ability and cognitive

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skill.^{18–20} Among surgeons, cognitive training improves performance, and cognitive assessment, particularly that of decision-making, correlates with higher levels of expertise.^{21–25} With this foundation, we consider learning experiences in intraoperative decision-making to be essential to the development of surgical autonomy. We also expect that the relationship between the attending and the resident plays a role in how frequently the resident makes decisions intraoperatively, and which decisions he or she makes.

With this exploratory study, we sought to produce a qualitative description of factors affecting operative decision-making, and the negotiation of this intraoperative responsibility.²⁶ The immediate post-operative period after laparoscopic cholecystectomy, when memory is fresh, provided an optimal time for attendings and residents to reflect on operative decisions, guiding behaviors, and the teacher-learner relationship.

2. Materials and methods

2.1. Participants and setting

A convenient sample of cases was identified—limited to laparoscopic cholecystectomies, to which residents in post-graduate-year (PGY)-2 and 3 had been assigned as part of their clinical responsibilities, and in which both resident and attending agreed to participate. A recruitment script was disseminated to all residents of an academic general surgery residency program prior to initiation of the study, and reviewed with both the attending and resident in writing and in person prior to each interview. Our study was approved as “exempt” by the University of Pittsburgh Institutional Review Board (PRO16090100). The cases and interviews took place at five teaching sites of the residency program, and 20 residents were eligible for participation. Surgeon subspecialties included minimally-invasive surgery, trauma and acute care surgery, and surgical oncology, but all participants were also clinically-active general surgeons, working within teaching services of the residency program.

2.2. Interviews with participants

Semi-structured interviews were completed in the immediate post-operative period (within 30 minutes of patient arrival in the post-anesthesia care unit). The resident interview occurred prior to the attending interview, with 2 exceptions due to surgeon schedule constraints. Resident and attending interviews were conducted separately.

Questions were developed by consensus of the co-authors (KH, EL, and GH), after review of the educational, cognitive skills, and surgical decision-making literature. The questions were piloted with a single surgical resident and attending—this prompted the addition of question #2, asking explicitly about decision-making, and the revision of question #5 for clarity, with final wording as follows. Pilot participants confirmed the relevance of each question to the constructs of intraoperative decision-making and resident autonomy, demonstrating good face validity for the instrument. Residents and attendings answered the same 5 questions, as follows:

1. What parts of the operation did the resident do?
2. What decisions did the resident make?
3. How did the attending help the resident progress or decide how to progress?
4. Were there times when the attending was operating, and why?
5. How did your relationship with this attending/resident affect the operation?

Interviews were conducted by a single interviewer (author KH), audio-recorded, and transcribed. Clarifying questions were included as needed, at the discretion of the interviewer.

2.3. Data analysis

All interview data were transcribed and evaluated for recurring themes using an inductive approach, i.e., without any *a priori* coding framework.^{27,28} A research team of three authors (KH, EL, and GH) met several times to discuss emerging themes, and compare emerging codes with new data. Interviews continued until thematic saturation was reached, utilizing this iterative process of transcription and analysis. Coding definitions and instructions were developed to assess reliability. Differences between groups (resident vs. attending) were evaluated using sign tests and McNemar's tests for paired data. Agreement between groups (resident vs. attending) was assessed via Cohen's kappa.

2.4. Interrater reliability

An interrater reliability analysis was performed using Cohen's kappa between 2 raters. One rater was author KH, and the second was an external reviewer (author MD), who did not have prior knowledge of the data or involvement in the code development process. The second-rater coding occurred after completion of all data collection and transcription.

3. Results

Thirty interviews were conducted after 15 laparoscopic cholecystectomies, with 9 residents and 8 attending surgeons. Demographic data is represented in Table 1. Eighty percent of these cases were elective, and 67% included a medical student or physician's assistant. More than half included some event or characteristic that interviewees qualified as “out of the ordinary,” such as patient factors, environmental adjustments, or technical difficulties. Two cases included a cholangiogram, performed due to attending routine practice and not for anatomic clarification.

Seven residents were in their PGY-3 year, and two-thirds of resident participants had done 30–50 prior laparoscopic

Table 1
Participant and case characteristics.

Residents	n (%)
PGY-2	2 (22)
PGY-3	7 (78)
Number of cholecystectomies	
10-19	1 (11)
20-29	2 (22)
30-39	3 (33)
40-49	3 (33)
Attendings	mean (±SD)
Years in practice	16.4 (±8.7)
Cases	n (%)
Emergent	3 (20)
Elective	12 (80)
Factors out of ordinary	8 (53)
Cholangiogram	2 (13)
Operating setup (resident)	
R-hand only operating	4 (27)
R hand operating, L hand camera	5 (33)
R hand operating, L hand retracting infundibulum	6 (40)
Others operating	
None	4 (27)
Medical student or PA	10 (67)
Chief resident	1 (7)

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