Continuity of Care in the Training Environment: Anesthesiology Residency in the Ambulatory Surgery Setting

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Abstract

Background Anesthesiology residents acquire clinical skills and acumen primarily from experience providing anesthesia for procedural cases, with prior preparation maximizing learning. Ambulatory surgery and associated management styles create fluid anesthesiology staffing—reducing predictability for learners and disrupting continuity of care.

Objective This prospective, observational study aimed to quantify anesthesia personnel changes in the operating rooms of a single teaching hospital.

Methods For a 5-week period, Monday through Friday, we recorded the surgical schedule on the prior evening. After the day of surgery, tracking software provided a list of cases performed. We completed electronic health record review for each case, recorded the actual anesthesiology personnel involved, and compared that to the personnel originally scheduled. We also recorded the occurrence of any permanent transitions of care within a case, the type of operation, and the anesthesia start and end times.

Results Anesthesia providers included 47 residents and 32 attending physicians. The study period included 1285 scheduled cases, 55% (n = 711) of which were started and finished by the originally scheduled resident and attending physician. Including canceled cases (126 of 1285, 10%) and added cases (207 of 1366, 15%), residents started anesthetics on patients and with attending physicians assigned to them from the day before 54% of the time. Transitions of care occurred in 19% (260 of 1366) of the cases.

Conclusions Anesthesiology residents prepare for many procedures that do not eventuate and frequently start other cases without prior opportunity for preparation and study. Transitions of care further reduce continuity of care and fragment supervision.

Introduction

Providing anesthesia to patients undergoing procedural cases serves as the primary medium for learning in anesthesiology—each assignment requires patient assessment, formulation, and execution of an anesthetic plan, general medical management, response to the unexpected, returning the patient to homeostasis, and finally, handing off care. Residents move toward autonomy as they are assessed, and supervision is correspondingly reduced throughout these sequential steps. Preparatory study and discussion specific to assigned patients and their surgical procedures allows for application of new knowledge. However, changes to the surgical schedule on the day of surgery may result in the reassignment of cases. In addition, residents may provide anesthesia for patients and surgical procedures other than those anticipated. Finally, if the anesthesiology resident or attending physician is relieved midway through a case, the pairing and potential for discussion and longitudinal feedback is disrupted. With frequent movement of anesthesia providers, less study is followed by application, supervision is provided for shorter periods, and patient interactions during residency become more fragmented.

Ambulatory surgery now dominates surgical volume, and the discipline of operating room (OR) management has emerged[1–3] to inform optimal use of ORs by, for example, reassigning patients to different anesthesia teams as the day evolves to avoid delays or unused OR time. The OR management literature typically defines *optimization* in terms of use and bed occupancy, without measurement of, or regard for, provider movements or continuity.[4–9] With

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rare exceptions, anesthesia providers are assumed to be interchangeable.[10,11]

In addition to schedule changes, the common practice of handoffs in the OR means that residents may induce anesthesia for a patient but not be present for their emergence from anesthesia. Within the anesthesia literature, fluid staffing is acknowledged, but quantitative descriptions are sparse.[12–14] The effect of fluid staffing on resident learning and patient outcomes has received little study. Duty hour regulations have necessitated increased handoffs in general, but its extent is specific to a specialty and has not, to our knowledge, been studied for anesthesiology.[15,16]

In this study, we measured anesthesia provider movements at a single teaching institution. A further aim was to quantify the contribution of duty hour regulations toward resident movements specifically.

What was known

Anesthesiology residents acquire clinical skills from experience in anesthesia management, with continuity of cases allowing preparation and optimal learning.

What is new

Slightly more than one-half of cases were started and finished by the originally scheduled resident and attending physician.

Limitations

Single-site study limits generalizability, with potential underreporting of some transitions; outcomes are limited to instances of discontinuity, not their effect on patient care or learning.

Bottom line

Transitions of care in anesthesia provision reduce continuity and fragment supervision, with both potentially reducing learning.

Methods

This prospective, observational study compared *originally scheduled* anesthesiology patient assignments with *actual* patient assignments to identify changes before and after the initiation of care. The study included all procedural cases staffed by the Department of Anesthesiology for a 5-week period, Monday through Friday, in a 500-bed university medical center. The only excluded location was the obstetrics unit.

For each day in the study, we recorded the surgical schedule as published from the day before, listing all originally scheduled "cases": the originally scheduled patients, surgeons, and procedures, as well as the anesthesia providers and scheduled ORs. After the day of surgery, we obtained a list of the cases actually performed, from OR tracking software. Electronic anesthesia health records were reviewed to record the following: the anesthesia providers and the duration of their care for the patient; anesthesia start and end times; the OR where the operation was performed; the patient's American Society of Anesthesiology Physical Status Classification; the type of anesthesia delivered; the surgeon; and the operation performed. Procedures were categorized into 12 mutually exclusive categories, and, where relevant, we adopted the definitions provided by the Accreditation Council for Graduate Medical Education for resident case requirements.[17]

We performed health record reviews for all originally scheduled cases listed on the preoperative schedule and for all patients identified on the tracking software after the day of surgery. Cases that were scheduled but did not proceed were recorded as *canceled*. Cases that were not originally scheduled but were identified on the tracking software postoperatively were recorded as *added*. A *reassignment* was defined as a discrepancy between the original schedule and the postoperative health record review in terms of which resident or attending was present at the anesthesia start time. A *transition of care* was defined as any permanent transition in care from a resident to another resident or from an attending physician to another attending. By definition, only originally scheduled cases were reviewed for reassignments. However, transitions of care were recorded for all cases, including added cases. Breaks and lunches were counted as permanent transitions of care only if they overlapped with the anesthesia start or end times. Paper anesthetic records were not reviewed for resident transitions of care because those transitions were known to be unreliably recorded.

We reviewed all resident reassignments to see if any were due to the "10-hour rule." We recorded any resident presence in a case after 8 PM and considered any reassignment of those residents on the following morning to result from duty hour regulations. The cutoff time of 8 PM was chosen as the earliest anesthesia end time that could reasonably preclude a resident from setting up for a 7:30 AM case. In addition, call schedules were reviewed to identify residents who may have been in the hospital after 8 PM but who were not present in a case at that time. We recorded reassignments of those postcall residents separately from those reassignments that were conclusively because of the 10-hour rule.

Schedulers and operating room managers were unaware that scheduling practices were being studied.

The institution's Institutional Review Board deemed this study exempt.

Results

A total of 58% (744 of 1285) of scheduled cases started and finished with the originally scheduled anesthesiology

TABLE **Reassignments and Transitions of Care by Type of Case and Personnel**

Type of Case	Cases, No.	Reassignment of Resident, No. (%)	Reassignment of Attending, No. (%)	Both Reassigned,[a] No. (%)
Scheduled	1159	215 (19)	248 (21)	114 (10)
		Resident TOC, No. (%)	**Attending TOC, No. (%)**	**Dual TOC,[b] No, (%)**
Scheduled	1159	113[c] (10)	133 (11)	51 (4)
Added	207	43[d] (24)	43 (21)	21 (10)
All Cases	1366	156 (13)	176 (13)	72 (5)

Abbreviation: TOC, transition of care.

[a] Reassignment of both attending physician and resident for a single case.
[b] Transition of care for both the attending physician and resident in a single case.
[c] Denominator is 1091 cases; data not available for 68 (6%) scheduled cases.
[d] Denominator is 179 cases; data not available for 28 (14%) added cases.
Note: The TABLE shows cases with at least 1 transition of care.

resident, and 55% (711 of 1285) of cases started and finished with the originally scheduled resident *and* attending physician. Forty-seven residents and 32 attending physicians provided anesthesia care during the study period. When the 207 "added cases" were also considered, 54% (810) of the 1492 scheduled or completed cases in the study period were started by a resident and attending physician scheduled from the day prior. In other words, residents started almost one-half of their cases with patients or attending staff not assigned from the day prior. The TABLE shows the breakdown of reassigned, scheduled cases by anesthesiologist: resident, attending, or both. Two of those reassignments were directly due to the 10-hour rule. There were no reassignments among residents who were postcall but not present in a case after 8 PM. FIGURE 1 shows the types of procedures performed.

Of a total of 1366 cases, 19% (260) included at least 1 transition of care. Those resident transitions of care were recorded via electronic medical records, which were used in 1270 (93%) of the cases. At least 1 resident transition of care occurred in 13% (156) of cases with the highest rate in the category of "added cases" (24%, 43 of 179; TABLE). Resident transitions of care increased with case duration—rising from 4% (9 of 242) of cases taking less than 1 hour to 58% (7 of 12) of cases taking between 8 and 9 hours (FIGURE 2). The period between 3 PM and 4 PM was most likely to have a resident transition of care (FIGURE 3). After 6 PM, a case was more likely than not to have included a resident transition of care (FIGURE 3). No cases in the study period were identified as lasting more than 24 hours or finishing after 7 AM the following morning; therefore,

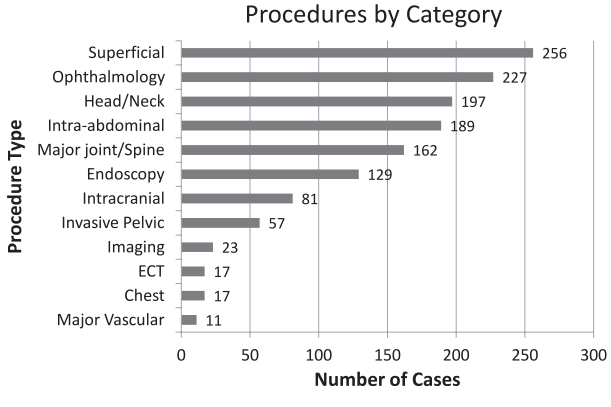

FIGURE 1 **Cases Categorized by Procedure, With Scheduled and Added Cases**

Abbreviation: ECT, electroconvulsive therapy.

Note: N = 1366

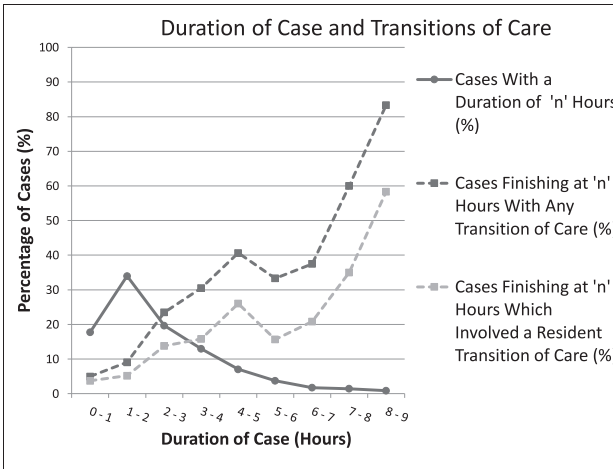

FIGURE 2 **Percentage of Cases and Durations with Any Transitions of Care, and With Scheduled and Added Cases**

Note: N = 1366

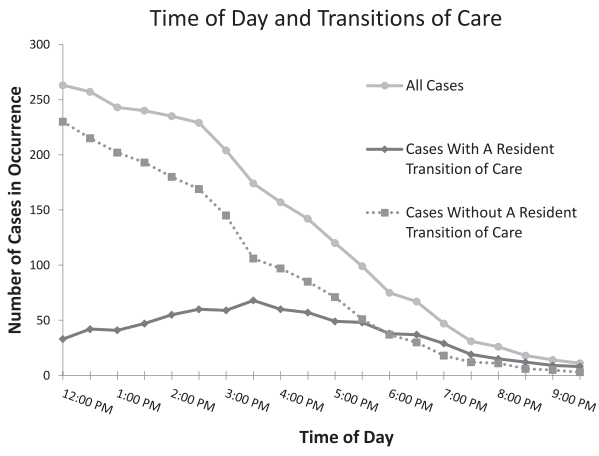

FIGURE 3 **Aggregate of All Cases From Noon Until 9:30 PM and Subsets of Cases With and Without Resident Transitions of Care, With Scheduled and Added Cases**

Note: N = 1366

none of those transitions of care were directly necessitated by duty hour restrictions. One case lasting more than 18 hours was identified—a 23-hour case that included 3 resident transitions of care.

Discussion

Patients assigned to anesthesia providers changed frequently—cases started as originally scheduled 63% (810 of 1285) of the time and finished as originally scheduled 55% (711 of 1285) of the time. The difference is explained by transitions of care, with 19% (260 of 1366) of cases having at least 1 transition. Additionally, 15% (207 of 1366) of all cases performed by residents were added to the schedule on the day of surgery, and the rate of cancellation on the day of surgery was 10%.

Resident duty hour restrictions minimally affected these results, a finding corroborated by reviewing staffing for an additional 5 weeks subsequent to the original study period. Between 6 and 8 reassignments were identified during that second period. At this residency program, residents are typically unassigned on mornings after home-call, in anticipation that they may not be able to start a 7:30 AM case. A consequence of the 10-hour rule is the need to maintain a larger group of residents (or nurse anesthetists) so that some of them are unassigned at any one time, thus avoiding delayed starts. This larger pool of residents is left sharing a fixed number of cases and experiences. Perhaps this is the most important effect of duty hour regulations on resident staffing—indirect effects of the limits that have not been studied and not measured in this study.

No data from other centers are available for comparison on this subject. Although these findings are specific to the institution, our medical center is unlikely to differ greatly from other teaching centers. Case volumes during the study period were consistent with average levels, as was resident staffing. More than 60% of scheduled surgeries were ambulatory cases, consistent with the national average.[3]

Limitations of our study include that it captured the surgical schedule at a single point in time on the day before surgery, but, in reality, the schedule is continuously changing, limiting our ability to distinguish when schedule changes were made—before the day of surgery (before 7 AM) or on the day of surgery. The study did not distinguish between nurse anesthetist movements and resident movements. However, that should change results minimally given the few nurse anesthetists (n = 5) and given that few nurse movements would not involve a resident. An added limitation is that transitions of care among attending staff likely were underreported because consecutive transitions of care made in quick succession may occur without documentation. Likewise, patients reassigned more than once before the anesthesia start time would be recorded as a single reassignment. A major limitation is that we measured only staff movements and did not assess the effect on patient or learning outcomes. We also did not collect data on the quality of communication associated with those movements or their effect on OR efficiency. Without measuring educational outcomes, it is not possible to assess the effect of these changes on the balance between the educational environment and what the Accreditation Council for Graduate Medical Education describes as "service commitments."[17,18]

Measuring outcomes in anesthesia is problematic.[19,20] Mortality and rare catastrophic complications are insensitive outcome measures, whereas many other indicators are not evidence-based and are influenced by the overall perioperative process.[19,21] Large, retrospective reviews, which reflect overall perioperative processes, have been able to stratify overall surgical risk by time of day, with conflicting findings.[22,23] This study assists in understanding the learning environment of current anesthesiology residents by quantifying provider movements at a teaching hospital. It also poses important questions for further research: How is resident learning facilitated by the opportunity to review patient history and procedure specifics before the day of surgery, and what is the effect of discontinuity on that learning? Do schedule changes limit feedback from supervisors? Are patient outcomes affected by staffing changes made on the day of surgery or by transitions during the case? Ultimately, how should the residents' education be adapted to this fluid environment?

Conclusion

Anesthesiology residents routinely prepare for patient assignments and procedures that do not eventuate and frequently start other cases without opportunity for prior study. Transitions of care further reduce continuity of patient care and fragment supervision. In the era of ambulatory surgery and modern OR management, the frequency of reassignments and transitions of care may represent an important consideration in the balance between education and "service" for those residents.

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