Building a perioperative quality and safety program: what are the best sources and uses of available data? Is anesthesiology still recognized as leaders in perioperative quality?

Part 1: Finding and assembling the data
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N.B. This handout is referenced in "PMID" format and functionalized so that clicking on the PMID will bring up the relevant Pubmed entry. Typing the number into the Pubmed search engine will also bring the article.

1. Introduction

Anesthesiologists face three major challenges in building a quality program. The first is the increasingly subtle nature of explicitly anesthesia-related adverse events in the operating room. Modern anesthesia delivery systems, monitors, airway management and vascular access tools, anesthetic agents, simulation, and awareness of "high risk" situations has reduced the number of "clean" or "unforced" events to near zero. The result is that the adverse events or near misses that do occur are complex, and have interlocking root causes that require individual event analysis to identify risk reduction strategies. Moreover, such cases may not be identified from automated search strategies since an anesthesia chart with normal vital signs may mask a desperate struggle in another domain. Finally, because anesthesiologists generally practice alone, an event with a modifiable root cause encountered by one anesthesiologist may not automatically "trickle down" to other anesthesiologists unless explicitly shared.

The second challenge is the difficulty in identifying postoperative outcomes after the patient leaves the PACU. Although intraoperative deaths are rare, postoperative deaths still occur from well-understood causes such as MI, PE, and aspiration. In addition, many intraoperative anesthesia-related events have consequences that extend well into the postoperative period and postoperative discoveries such as corneal abrasions, infiltrated IVs, and peripheral neurologic injuries from regional blocks may have intraoperative antecedents related to anesthesia care.

Thirdly, difficulty in identifying postoperative complications is further complicated by the relative lack of knowledge regarding how intraoperative events map to postoperative complications. Once explicit abnormalities are excluded, knowledge regarding the effect of anesthesia management on the incidence of relevant postoperative outcomes such as renal injury, SSI, ARDS, or MI is poor. As an example, although intraoperative mean blood pressures correlate with the incidence of postoperative renal injury (PMID 23835589 and 26181335), evidence that treating those blood pressures reduces the risk is less robust. A study of high vs low mean blood pressures in critically ill patients, for example, (PMID 24635770) found no effect on renal injury. Similarly, although high glucose levels in the OR clearly correlate with increased postoperative complications, evidence that treating those levels reduces the risk of adverse postoperative events is less clear (PMID 23235393) and the glucose "target" for ideal outcome in diabetics may differ from that in nondiabetics (PMID 24009267). How anesthesia drugs might themselves affect perioperative outcomes is also evolving. Relationships between narcotic use and postoperative infection (PMID 21989372) and between inhaled anesthetics and postoperative lung injury (PMID 19417610) are examples of potential routes of influence.

2. Event reporting: the backbone of an Anesthesia quality program

A robust Anesthesia quality program thus begins with a culture that can identify such cases and share them with other providers. Because self-report is notorious for not capturing all cases (PMID 8556111, 21471476), and many adverse events are invisible unless reported, providers should feel that they will not be punished or shamed for reporting, but instead that they are contributing to the department by identifying a risky environment or dangerous latent error. In Illinois, legal protection against medicolegal discovery for QI purposes offers another reason to report: to time-stamp the beginning of CQI investigation. Efforts to make reporting better should also extend to reporting mechanisms. Web-based systems are common and easy to set up, many EMR systems include a reporting mechanism including the ASA-run AIRS (https://www.aqihq.org/airs/airsIntro.aspx) system.

Once identified, events with potential to learn from them should be disseminated to the rest of the department. Such potential can include equipment failures or modes, wrinkles in pharmacy practice, and new clinical or research protocols. At the University of Chicago we use CQI conferences to disseminate these "quick hits" so participants know when to expect the information download.

3. Postoperative complications: Identifying adverse events outside the OR suite

Detecting postoperative events once patients have left the PACU is considerably more difficult. Many EMRs treat the OR as a separate encounter from the rest of the hospital, so when the patient leaves the PACU they actually transition to another encounter. As few systems easily map postoperative events to intraoperative events, the existing infrastructure in many hospitals can be poor. This section will contain suggestions and caveats with respect to these longer term outcomes.

3a. *Leverage the hospital NSQIP and STS reporting system*. Unlike STS, which relies on self-reporting, NSQIP installs an analyst into every hospital to perform chart analysis and independently verify whether a case of postoperative respiratory failure really happened. NSQIP tracks several relevant surgical outcomes including respiratory failure, surgical site infection, renal failure, and cardiovascular complications. Ideally, the Anesthesia quality apparatus and NSQIP should work closely together so trends in outcomes can also be shared. NSQIP produces a "semi-annual report" which compares your hospital to others and identifies outliers.

3b. *Use your billing data.* Although billing data does not track outcomes, it can track how many procedures are done and by which providers. Estimates of central line insertion rates, conversion rates from regional to general, and ASA class are all available in most billing systems. Such data are relevant to safety…for example identifying increasing numbers of blocks or central lines being done in unanticipated locations…or declining numbers of procedures and a possible need for yearly certification training.

3c. *Seek out the databases of other entities in the hospital.* It's highly likely that many of the services that might be activated by a postoperative adverse event are maintaining their own databases. Inpatient dialysis, Cardiac Cath lab/consult services, and the Stroke center are all examples of specialty services keeping their own data. Merging their databases with your billing data may help identify cases where renal, cardiac, or neurological injury have occurred. As an example, although routine, postoperative troponin measurement is not common and most postoperative myocardial injury is silent (PMID 27433900). But cardiology consultation may be universal for postoperative troponin bumps, and if they keep a list of patients they have seen, it could easily be cross-referenced with billing data to identify postoperative cardiology consultations. Similarly, if a postoperative patient requires new dialysis, those patients can be identified using a database match. In our hospital, we track postop

neurologic complications of peripheral nerve block in part by a liason with the hospital physical therapy department, who are almost always called to see patients with foot drop, numbness, or focal muscle weakness.

This approach illustrates an important principle relevant to Anesthesia quality. Because identifying many relevant postoperative outcomes is difficult, to expect any tracking method to identify all cases with 100% sensitivity and specificity is too much effort. Additionally, since "eyes on the chart" are needed to properly identify fixable issues, some degree of manual chart review will be needed regardless of what tracking system is deployed. As an example, the EPIC registry report to identify reintubations can be confused by patients who were intubated (and extubated) earlier in the admission, but now present to the OR. If the old endotracheal tube was not removed from the list of devices attached to the patient, EPIC will interpret it as a reintubation. But if the error rate is reasonable (<100 cases), then the remainder "edge" cases can often be reviewed by hand. Such review may help fine tune detection algorithms.

4. Conclusion

As technology makes intraoperative care easier and safer, the task of detecting anesthesia adverse events becomes more difficult. Instead, intraoperative adverse events have become more complex to analyze, and often may not be detectable from automated analysis. Robust event reporting thus has become more important in detecting, and analyzing intraoperative events that may occur. Doing so requires focused adherence to "just culture" principles and viewing events as opportunities to improve our understanding of risk rather than something that needs to be fixed.

An equally important challenge is to identify adverse events that occur postoperatively. Because transfer from the floor to the PACU or ICU is often processed as a move to a new encounter, mapping postoperative complications to the antecedent anesthetic can be difficult. Here, imagination can help. Billing data creates an extremely accurate record of anesthetics and ancillary procedures such as central lines. Other sources of data, including NSQIP and STS databases, records kept by services likely to become involved with an adverse postoperative event such as renal failure or a postoperative MI, and pharmacy databases to identify instances of drug use referable to a postoperative event (erythromycin eyedrops for corneal abrasions) are also potential ways to track postoperative events.

Few evidence based, meaningful quality metrics exist for anesthesiologists. To fulfill the goal of being a perioperative physician and identify best practice, anesthesiologists will need to be able to track the consequences of intraoperative decisions in to the postoperative period. Until tracking becomes routine and embedded into future EMRs, obtaining data from whatever sources are available will be necessary.