ANALYSIS OF NOTEWORTHY INDICATORS ON THE ANESTHESIA RECORD: A PROSPECTIVE, MULTIREGIONAL STUDY

Introduction

Anesthesia providers are responsible for providing safe care in an increasingly complex clinical environment. Innovative technologies, new pharmaceuticals, challenging patients, and an ever-expanding variety of surgical interventions combine, under the umbrella of cost-effectiveness and human factors, to make the modern delivery of anesthesia care a formidable enterprise. Fundamental to this task is systematically documenting what occurs; thus the anesthesia record is a testimonial of care provided, a mechanism to facilitate quality assurance, a means of documenting Medicare/insurance compliance, and a tool to capture charges.

The accuracy of the anesthesia record is essential in the legal definition of the accepted standards of patient care. Both the American Society of Anesthesiologists (ASA) and the American Association of Nurse Anesthetists (AANA) have formally endorsed anesthesia record-keeping standards. The goal of the present study was to identify 13 noteworthy charting components and to examine anesthesia records in diverse geographic locales prospectively for the presence or absence of the defined components.

Materials and methods

Institutional approval for the present study was obtained at each of the sites, which were located in the states of California, Florida, Maine, Michigan, New Hampshire, New York, and Virginia. The sampling pool consisted of 4 academic centers and 5 community hospitals. A Delphi technique ultimately yielded 13 noteworthy indicators (Table). Inclusion of a given indicator was based upon (1) national charting standards recognized by both the ASA and the AANA, (2) issues inherent in medical-legal documentation, and (3) investigator-determined face validity. The Delphi technique involved seeking the opinion of domain-experienced group members through a defined procedure of independently ranking items followed by

Table. Study indicators*

<table>
<thead>
<tr>
<th>Charted variable</th>
<th>Number of missed events</th>
<th>% Events missed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patient identification</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Surgery and/or anesthesia start time</td>
<td>654</td>
<td>13.1</td>
</tr>
<tr>
<td>Anesthesia provider name(s)</td>
<td>11</td>
<td>0.2</td>
</tr>
<tr>
<td>Heart rate/rhythm</td>
<td>34</td>
<td>0.7</td>
</tr>
<tr>
<td>Blood pressure</td>
<td>69</td>
<td>1.4</td>
</tr>
<tr>
<td>Oxyhemoglobin saturation</td>
<td>30</td>
<td>0.6</td>
</tr>
<tr>
<td>End-tidal carbon dioxide</td>
<td>105</td>
<td>2.1</td>
</tr>
<tr>
<td>FiO2 or O2/H2O/air liter flow</td>
<td>162</td>
<td>3.2</td>
</tr>
<tr>
<td>Volatile agent concentration</td>
<td>89</td>
<td>1.8</td>
</tr>
<tr>
<td>Airway management</td>
<td>155</td>
<td>3.1</td>
</tr>
<tr>
<td>Intravenous fluid</td>
<td>254</td>
<td>5.1</td>
</tr>
<tr>
<td>Emergence from anesthesia</td>
<td>1,426</td>
<td>28.6</td>
</tr>
<tr>
<td>Surgical positioning</td>
<td>943</td>
<td>18.9</td>
</tr>
</tbody>
</table>

A total of 4,989 records were evaluated.

Key words: Documentation, monitoring, quality assurance, record keeping.
continued reranking based on awareness of group trend until a final consensus was reached.\textsuperscript{3} Face validity was used as a preliminary step in the process of indicating whether an item, instrument, or phenomenon, on the face of it, seemed to be an appropriate record indicator meeting published charting standards. For purposes of this study, the investigative team served in the joint roles of performing the Delphi discrimination of indicators and determining the face validity of each indicator. The importance of each indicator was thus based upon surviving the Delphi process, achieving high face validity, being a representative charting standard, and a general sense that each record indicator might prove valuable in addressing a provider’s activity in a litigated matter (K. Kirsner, CRNA, MS, JD, and L. Le Bel, CRNA, ARNP, Med, JD, oral communication, January 1999).

Each record indicator was believed to be important to documenting a basic core of information describing the monitoring and care provided in a generic clinical setting. Interrater reliability was established during pilot testing at a nonstudy institution; there was nearly perfect agreement (3 conflicts in 325 events; 99.08\% agreement) in evaluating the record indicators on 25 anesthesia records by 5 clinicians not associated with the investigation.

The convenience sample consisted of examining the anesthesia records generated in prospectively identified operating rooms at each institution. Only records involving the administration of a volatile anesthetic for the purpose of achieving general anesthesia, prepared by nurse and physician providers with at least 6 months of experience in anesthesia care, were examined. No identifying patient, provider, or institutional data were recorded.

The record indicators were scored in a “present/absent” format. For physiologic or mechanical values (eg, blood pressure value, agent concentration), an event was considered “missed” if a distinct location for that value on the anesthesia record was not filled in.

All data were pooled and described descriptively in terms of total number of records evaluated, number of record indicators missed, and the percentage of charts that had that missing indicator. No intramedical center or provider-based comparisons were undertaken due to strict institutional review board and institutional criteria and because such comparisons were not a study objective. The goal was to describe the overall phenomena in terms of rate of compliance rather than to attribute performance standards to particular cohorts (provider type, institution type, and geographic locale).

Results
A total of 4,989 anesthesia records were evaluated. The anesthesia record indicators missed ranged from 0.0\% (patient identification was never missed) to 28.6\% (there was no notation regarding emergence from anesthesia). Of the 13 study indicators, 10 were omitted on less than 6\% of the records; 3 (surgery and/or anesthesia start time, notation regarding emergence, surgical positioning noted) were omitted on more than 13\% of the records. The Table displays the record indicators and the rate of omission for each indicator.

Discussion
Diversity characterizes anesthesia record keeping. Before the conduct of this study, 1 of the investigators (CB) asked various practitioners in different geographic/practice settings to provide a copy of their respective institution’s anesthesia record. Although the records shared certain common characteristics (eg, a place to chart blood pressure, a location to note drugs administered, a section to record monitoring approaches, a patient identification area), there was extensive variation in the overall record pool in terms of design, size, ease of use, complexity, and prompts.

Petty \textsuperscript{4} studied 202 clinical practice settings in the United States and abroad, finding that 22 respondents noted “outdated” records (his term suggesting a chart that did not allow for the breadth and depth of contemporary standards), while 29 requested a copy of any improved prototype. Anesthesia departments probably individualize their documentation approaches based on local, defacto standards, and individual preferences. Modern records may increasingly be based upon related human factors–oriented research, a situation that may improve considerably with the advent of automated record-keeping instrumentation.

Devitt et al\textsuperscript{5} evaluated completeness and accuracy of anesthesia records, concluding that overall completeness of records was relatively low. Unfortunately any comparison with the current study is limited, as the other effort examined only 124 subjects, included medical student-prepared records, and used a nonpatient, simulated environment where 3 critical events were artificially introduced. The authors noted that while automated record keeping may improve the accuracy of anesthesia records, the implementation and maintenance costs are very high, and user resistance can be substantial.

The current study focused upon charting indicators judged to be essential based on a number of considerations including published monitoring standards, medical-legal considerations, the Delphi analysis, and
high face validity. While other, equally essential charting components could be argued for, we limited the study to the 13 noted in the Table to make the study manageable, meaningful, and representative.

We observed a number of documentary components that were omitted from the records analyzed. Although patient identification was present on every record (0.0% failure rate), all the other indicators were associated with a failure rate ranging from 0.2% (failure to document provider) up to 28.6% (failure to document emergence from anesthesia). The overall consistency of the record keeping cannot be compared to a baseline (there are no other published data) so no “rating” can be provided. However, given the inconsistency in the charting of the studied record indicators, certain questions come to mind. Does the anesthesia record need redesign, or does documentation require increased emphasis in educational and quality assurance programs? Is the anesthesia record reflective of quality of care? How do we define “good,” “mediocre,” and “poor” documentation; that is, what are the objective criteria?

From a human-factors perspective, errors can be viewed as occurring more often when a person is mismatched to a task or when the environment is characterized by unfamiliarity, is not user-friendly, or the task density or complexity is so high that overall performance suffers. A host of performance-shaping factors (eg, skill, knowledge, experience, stress, or environment) will modify any human activity whether it be flying an airplane, painting a picture, hammering a nail, firing a weapon, or documenting the course of an anesthetic.6

One performance-shaping factor that profoundly influences clinicians is the daily production pressure that they encounter, that is, the urgency to complete a task based on resource (time, money) utilization. Task density is very high during induction of and emergence from general anesthesia. The challenges inherent in delivering patients to the recovery area, preparing for a subsequent case, and facilitating room turnover likely played a role in the observed 28.6% failure to document anesthetic emergence.

Mistakes can be thought of as errors in judgment or procedure. For example, giving halothane and succinylcholine to a patient known to be susceptible to malignant hyperthermia is a mistake, attributable to insufficient information, inappropriate decision making, inadequate education, or failed supervision. Slips (errors of omission and errors of commission) take place when a behavior occurs—or fails to occur—due to an unexpected interruption in a well-established routine. For example, a syringe/drug swap is a classic example of a slip. Failure to chart the amount of oxygen that a patient received during anesthesia, which occurred in 3.2% of the current observations, is an example of an error of omission. What accounted for this omission, or the 18.9% failure to document surgical position, is unclear and merits further study.

Four limitations of the current study were identified. First, the study did not control for provider attributes. While it could be argued that this left out important information (eg, gender, age, education, culture, case type, practice style, personality traits), we elected to describe the phenomenon of omission in the most generic sense to set the stage for future investigation. Second, a comparison of accuracy of what occurred during care and what was charted was not performed. This has been done previously, with numerous investigators demonstrating significant variations from what appears on the record, compared with what actually occurred.7–9 Third, we were unable to define or describe the role of a relieving anesthesia provider on the anesthesia record. And fourth, while failure to document information may not be an “error” in the same sense as that usually applied to patient care-related error, there may be shared root causes and remedies that deserve consideration.

Does record keeping detract from or enhance intra-operative vigilance? This has not been well studied, although there is evidence, in simulating an abnormal, displayed physiologic variable, that providers are equally attentive to what is going on regardless of whether the provider or an assistant does the charting.10 Other authors, based upon work performed in a simulator environment, examined the anesthesia record as a measure of mental work load and performance, arguing that the resultant errors in documentation may be used as a marker for quality of the care provided.11

Conclusion
In conclusion, the goal of the present multicenter study was to define the incidence of omission of noteworthy indicators on the anesthesia record. We found inconsistencies in record completeness and suggest that further studies be undertaken to better understand the antecedents for our observations and to evaluate strategies for improving compliance with national standards of documentation.

REFERENCES


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