

Title: ANESTHETIC RELATED COMPLICATIONS: PROSPECTIVE MODEL TO IDENTIFY PERIOPERATIVE RISKS

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Introduction. Risk factors for anesthesia and surgery have been assessed by attempting to obtain perioperative morbidity and mortality statistics retrospectively. This process lacks uniform reliability. The purpose of this study was to develop and test a multifactorial, perioperative model to identify anesthesia related complications (ARCs) in the operating room (OR) and recovery room (RR) that could progress to morbidity or mortality.

Methods. A model was constructed to describe perioperative patient flow from hospital admission to discharge (Figure). Following institutional Human Subjects Committee approval, the model was tested prospectively. Data were accumulated by a double blinded, trained investigator who did not participate in OR or RR clinical management. Weekdays were assigned for data collection by a random numbers table over a period of 11 months. Excluded from the study were individuals < 18 years, obstetrical patients, and those undergoing intracardiac operations. All other patients scheduled for elective or emergency operations undergoing general or regional anesthesia from 0700 to 1900 hrs. were included. ARCs were defined, as modified from previous studies, as pivotal occurrences requiring physician or nursing interventions that could lead, if not discovered or corrected in time, to an undesirable outcome. These potential perioperative complications included hypotension (< 30% of admission systolic pressure); hypertension (> 30% of admission systolic pressure); dysrhythmias (from continuous EKG monitoring); prolonged airway management (manual or artificial airway); hypothermia (< 34°C on RR admission); nausea and vomiting requiring treatment; electrolyte abnormalities; hypoxemia; hypercarbia ($\text{PaCO}_2 > 55$ torr, acutely); emergence delirium; severe shivering; pneumothorax, aspiration pneumonia; pulmonary embolism; pulmonary edema; ventricular tachycardia; myocardial infarction; angina; cardiac arrest; or mortality. At the time of RR admission, the blinded investigator completed a data collection form describing perioperative patient status as assessed from the preanesthetic note, laboratory data, consultation records, intraop anesthetic record, and discussion with the attending anesthesiologist. These assessments allowed a determination of patient status plus pivotal occurrences during induction, maintenance, or emergence of anesthesia. Data regarding RR ARCs were accumulated by direct observation of the RR course by the same blinded investigator who was not involved in clinical care. Statistical analyses were used to characterize central tendency and variance of the sample.

Results. The study sample of 425 subjects (males:female = 183:242) included characteristics [mean, \pm standard error (range)] as follows: age [48.8 ± 1 yr (18-96)]; weight [71.4 ± 0.9 kg (38-159)]; and height [167 ± 0.6 cm (109-193)]. Anesthetic and operative characteristics further describe the sample (Table 1 & 2).

TABLE 1: Anesthetic Characteristics (n = 425)

Anesthesia Time (minutes)	125 \pm 4 (mean \pm SEM)	10-630 (range)
Anesthetic Type	N	% of Total
General	334	78.6
Regional	57	13.4
Combination	34	8.0

ASA Physical Status

I	135	31.8
II	179	42.1
III	88	20.7
IV	10	2.4
Unclassified	13	3.1

TABLE 2: Operative Characteristics (n = 425)

Surgery Time (minutes)	91 \pm 4 (mean \pm SEM)	3-540 (range)
Operative Type	N	% of Total
Intraabdominal	97	22.8
Pelvic	107	25.2
Peripheral	190	44.7
Intrathoracic	5	1.2
Other	26	6.1

In the OR, 101 patients experienced 139 ARCs for an average occurrence rate of 1.4/patient. Moreover during the RR stay, 133 patients experienced 191 ARCs for an average occurrence rate of 1.4/patient. Hence, 24% of the patients experienced at least one ARC in the OR, while the same value for the RR was 31%.

Conclusion. The proposed perioperative model can be applied systematically to identify ARCs. Moreover, testing confirms that ARCs requiring intervention by anesthesia personnel occur frequently in the OR and RR. By focusing on type, frequency, and timing of these physiologic alterations (ARCs) it may be possible to predict variables most likely associated with perioperative risk, mortality, and morbidity.

PERIOPERATIVE MODEL

