Title: Effect of Two Interventions on the Rate of Anesthesia Complications

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INTRODUCTION: Using a simple self-reporting instrument, we determined the baseline rate of anesthesia related problems occurring in the operating room (OR) and recovery room (RR) and assessed how the rate was affected by feedback of information and the introduction of pulse oximetry.

Methods: On admission to the RR, the patient's anesthetist documented Recovery Room Impact Events (RRIE), defined as an unanticipated, undesirable, possibly anesthesia-related effect that required intervention, was pertinent to recovery-room care, and did or could cause at least moderate morbidity. Patient data and RRIE's that occurred in the OR were entered on a 1-page form listing 80 events by the patient's anesthesiologist/CRNA when he/she reported to the RR staff. A RR nurse or RR anesthesiologist documented events that occurred in the RR. The severity of the effect of all events was evaluated by the anesthesiologist who discharged the patient from the RR. Forms were deposited in a locked box; all information was confidential and anonymity assured. Following a 17-week control period with no feedback of data, intense feedback of grouped (anonymous) RRIE rates was provided. At the start of the 29th week, pulse oximeters were installed in all anesthetizing locations and data were collected through week 65. To assess the accuracy of information entered on forms, blinded investigators, using specific operational definitions, completed forms based on information in the anesthesia record. The monthly average resident-experience was computed to evaluate the effect of experience on RRIE rate. Anesthetists were surveyed to assess the extent of changes in their reporting behavior or interpretaton of defintion of an RRIE over the course of the study. Significance of planned comparisons was judged according to Bonferroni's inequality using a (simultaneous) level of 0.05.

Results: (Table I) Among 12,088 patients (71% of all RR admissions), 18% had at least one RRIE in the OR or RR. The ten most common RRIEs are listed in Table 2. Feedback of information produced no demonstrable change in the rate of RRIEs. Following introduction of pulse oximetry, significantly fewer patients experienced RRIEs in the OR, and hypotensive and hypovolemic RRIEs in particular. The distribution of patient ages and ASA status was equivalent during the three time periods. Resident experience and return rate of the forms appear unrelated to the decrease in RRIEs. Anesthesia staff threshold for documenting RRIEs and, in particular, hypotensive RRIEs, appeared to change little during the study. Serious outcome (transfer from the RR to an ICU), was rare (0.4%), and most such patients required only monitoring or intensive nursing care.

Discussion: No standard measures exist to assess the quality of anesthesia care nor the effects of specific clinical interventions on outcome. The effect of broad-based clinical interventions are not easily measured because the rate of serious permanent injuries and death is very low. RRIE's are a subset of anesthesia-related complications which can be monitored in lieu of the more rare serious adverse outcomes. If interventions reduce the number of RRIE's, we could infer that more serious outcomes could also be reduced. We were unable to identify a reduction in the total rate of RRIEs or any specific RRIE associated with the feedback of complications information, by itself. This may be due to the relatively short sample period, necessitated by an imposed need to introduce pulse oximetry earlier than planned in the original study design. But, the absence of a change still suggests that a more aggressive, targeted approach to risk reduction is necessary, e.g. feedback of individuals' complications, prewarming of OR's to reduce hypothermia. The lack of a randomized control in the experimental design precludes a definitive inference about an association between pulse oximetry and the RRIE rate. But, routine monitoring of pulse oximetry did appear to lower the rate of hypotensive and hypovolemic events specifically. Pulse oximetry may be providing sufficiently early detection and correction of clinical problems to rule out the need to report the event to the RR staff.

TABLE 1
SUMMARY DATA

	Control	Feedback	Oximetry
#weeks	17	11	37
# patients	4339	2854	9929
forms returned (%)	3227(74%)	2022(71%)	6839(69%)
% with OR RRIEs*	16.4%	14.3%	12.4% @
% with RR RRIEs*	8.6%	7.3%	6.2%
% with 1 or more +	21.1%	18.9%	16.2%
Serious outcome	0.4%	0.4%	0.5%

* denominator = # of patients for whom form completed
+ denominator = number of patients for whom OR and RR information documented.
@statistically different from preoximetry, p<<0.0001

TABLE 2
% OF OR PATIENTS WITH EVENT

	Control	Feedback	Oximetry
hypotension	5.4	4.8	3.8 +
arrhythmia	4.4	3.7	3.7
hypertension	1.6	1.5	1.4
unanticipated difficulty with intubation	0.99	0.89	0.72
hypoventilation	0.68	0.99	0.73
hypovolemia	1.0	0.59	0.42 +
bronchospasm	0.65	0.54	0.56
laryngospasm	0.22	0.54	0.45
hypoxia/hypoxemia	0.34	0.25	0.47
prolonged intubation	0.28	0.54	0.26

* denominator = number of forms completed
+ significantly different from pre-oximetry, $p < 0.05/20 = 0.0025$.