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TITLE: Pulse Oximetry uncovers hypoxemia and decreases the incidence of evidence for myocardial ischemia during anesthesia. A Prospective Study of 20,802 patients

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Pulse oximetry (POX) has been welcomed as a non-invasive, easily applied and continuous means of monitoring oxygen saturation and thus discovering and correcting even slight hypoxemia before it can worsen and cause damage. We tested the hypothesis that POX would not only discover hypoxemic events during anesthesia and in the PACU, but also by enabling an early diagnosis, would reduce the incidence of acute adverse events linked to hypoxemia.

Methods: The study which was approved by local ethics committees, was carried out during 17 consecutive months in 5 Danish hospitals. All in-patients aged 18 years or older, whether scheduled for elective or emergency operations, regional or general anesthesia, except for cardiac and neurosurgical procedures, participated in the study. Patients gave informed consent and were randomly assigned to be monitored with pulse oximetry during anesthesia and in the PACU, or not to be so monitored. The selection of anesthesia and all other pre-, intra, and post-anesthesia treatment, and other monitoring modalities were kept as customary in the participating hospital. An adverse event was defined as requiring intervention to prevent morbidity, and 42 were prospectively described.

Results: 10,312 patients were in the POX, 10,490 in the nonPOX control group. During anesthesia (and in the PACU) 11.2 % (14.3%) of patients in the POX, and 3.3% (1.7%) in the non-POX group experienced respiratory events (for both $p < 0.00001$), as there was a 19 fold incidence of diagnosed hypoxemia in the POX over the non-POX group in the OR and PACU. In the OR cardiovascular events were observed in 7.8% of both groups, but myocardial ischemia as defined by angina or ST segment depression was detected in 12 patients in the POX group, and in 26 patients in the control group ($p < 0.03$). In the PACU 2.2% of the POX group and 1.8% of the nonPOX group was diagnosed as suffering cardiovascular events ($p > 0.02$). Bradycardia was noted in 0.4% in the POX and 0.2% in the nonPOX group ($p < 0.003$). 13.3% of the POX patients and only 3.5% of patients in nonPOX group were discharged from the PACU with supplemental oxygen.

Conclusion: We expected that pulse oximetry would enable the detection and treatment of hypoxemia. The unexpected observation that evidence of myocardial ischemia was less common in patient monitored with POX suggests an association between pulse oximetry, hypoxemia, and myocardial ischemia that requires future studies.

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Title: PHYSICIAN AGREEMENT IN JUDGING CLINICAL PERFORMANCE

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Introduction: How well do anesthesiologists agree when judging the performance of their peers? In medical malpractice proceedings, physician experts rely on their own implicit standards in rendering their opinions. To measure agreement on standard of care judgments, we asked pairs of practicing anesthesiologists to independently review identical anesthesia malpractice claim files and judge the appropriateness of the anesthesia care.

Methods: Thirteen anesthesiologist-reviewers visited the offices of six insurance companies to review files of closed malpractice claims against anesthesiologists. Pairs of anesthesiologists reviewed randomly selected files without consultation or discussion among partners. Each reviewer pair examined 3 files, completing an extensive summary of each case. We measured agreement on a single question: Was the anesthesia care appropriate, less than appropriate, or impossible to judge? Standard of care judgments were based on the implicit criterion of "reasonable and prudent" practice, as are expert witness opinions in malpractice litigation. Because severity of patient injury influences reviewer judgments of appropriateness of care,¹ we measured the level of agreement in two subsets of claims based on severity of injury as well as for the entire set of claims: 1) the subset of cases of temporary injury (e.g., emotional distress, sore throat, or uncomplicated pneumothorax) and 2) the subset of claims for permanent injury (e.g., brain damage or death). Chance corrected levels of agreement between paired reviewers were measured using the kappa statistic^{2,3} with $p < 0.05$ considered statistically significant.

Results: A total of 42 claims were reviewed by pairs of anesthesiologists. Sixty percent of the claims were for permanent injury and 40% were for temporary injury. More than half of the claims involved death, nerve damage or brain damage. Overall agreement was in the fair to good range (Table). There was **no agreement** beyond the level expected by chance on the subset of claims for temporary injury. Agreement was **fair to good** on claims for permanent injury.

Discussion: We conclude that, in the absence of explicit guidelines for judging quality of care, there is a lack of consensus among anesthesiologists on standard of care judgments in the case of temporary injury and only fair agreement when the injury is permanent. Our results suggest that, in medical malpractice proceedings, conflicting opinions about standard of care may be relatively easy for attorneys to find, especially in the case of temporary injury.

AGREEMENT ON APPROPRIATENESS OF ANESTHESIA CARE

	Kappa	p<	Level of Agreement
All Claims (n=42)	0.42	0.01	Fair to good
Temporary Injuries (n=14)	0.15	0.23	Slight
Permanent Injuries (n=25)	0.51	0.01	Fair to good

¹Caplan et al: JAMA 1991; (in press).

²Fleiss JL: Psych Bull 1971; 378-382.

³Fleiss et al: Psych Bull 1979; 974-977.