Title: PREDICTORS OF POST-ANESTHESIA RECOVERY COMPLICATIONS

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Introduction. Patients present to the recovery room with a myriad of associated information. The task of recovery room personnel is to utilize that information in the best way possible to provide a minimum-risk recovery from anesthesia. As part of another study involving recovery-room nursing allocation, a great deal of information concerning the presenting state of the recovery room patient was made available to us. The purpose of this study was to identify that subset of this information which might help us to select those patients which were at higher risk for post-anesthetic complications in the recovery room.

Methods. After clearance from the Human Subjects Committee and waiver of any need for informed consent, a survey of recovery room admissions was undertaken. Data recorded for 529 patients over a 2-month period included sex, age, weight, height, ASA physical status, number of peripheral IV's, number of calibrated drips, presence of a central IV, endotracheal tube, drains, arterial line, Swan-Ganz pulmonary artery catheter, and ventilator. Also, patients were classified as from the operating room (OR) or non-OR (pain, ECT, lines). Airway was classified as (1) clear, (2) oral/nasal, (3) manual support, (4) intubated, or (5) tracheostomy. Patients were followed in the recovery room until discharge, and the occurrence of any complications during recovery was noted. Stepwise discriminant analysis was used to identify that subset of the above variables which would maximally discriminate between that group which would undergo complications from that group which would be free of complications. Rao's $\overline{V}$[1], a generalized distance measure, was used as the discrimination criterion, and significance for variable entry into the equation was defined at $p<0.05$. X^2 and Student's t-test for grouped data were subsequently used with significance defined at $p<0.05$.

Results. Of the 529 consecutive admissions to the recovery room, 302 were females, 227 males. Age ranged from less than a year to 96 yrs with mean ± SEM of 41.7± 1 yrs. ASA physical status classifications were I (42%), II (39%), III (17%), IV (2%), V (<1%), and 11% of the admissions were emergencies. Average weight was 66.4 kg, average height 164 cm. OR admissions comprised 89% of admissions; non-OR admissions (pain, lines, ECT) made up the remaining 11%. Airways were classified as clear (60%), oral/nasal (24%), requiring manual support (3%), intubated (11%), and tracheostomy (2%). Mean number of peripheral IV's was 1.10±0.02 (SEM) and 11% of patients had at least one central line. Sixteen percent had drains on admission, 10% had arterial lines, 2% required ventilators, and 1% had Swan-Ganz pulmonary artery catheters in place. Complications in recovery room occurred in 32 patients. Types of complications included hypertension (DBP>95), hypotension (SBP<80), bradycardia (P<50), dysrhythmias (multifocal or >5/min unifocal), laryngospasm, cyanosis, bladder spasm with bleeding, and extreme drowsiness. After application of discriminant analysis, only one of the recorded patient variables--patient age--was a significant discriminator between those who would have and those who would not have complications. The classification functions for the two groups were:

Group 1: (No complications)=0.118xAGE - 3.328 (1)
Group 2: (Complication) =0.149xAGE - 4.942 (2)

That function with the highest value is the predicted group membership. Equations (1) and (2) can be set equal to zero and solved simultaneously for AGE, with the result, AGE=52. Thus, the discrimination rule would predict recovery complications for those older than 52. Using this rule, 64% of the cases were correctly classified as shown in the Table. Of the 529 cases processed 13 had at least one missing discriminating variable, so the Table accounts for 516 of the 529 cases surveyed. As a check on the discriminating rule the number of recovery complications with those patients over 52 was found to be significantly higher than the number of complications with those patients under 52 ($X^2=14.1$, $p=0.0002$). Also, the average age for those patients with recovery complications was 59±3 (SEM), while the average age of those with no complications was 41±1 (SEM) ($p<0.001$).

Conclusions. Goldman et al[2] have demonstrated the beneficial application of discriminant analysis for clinical decision-making. They contend that this statistical decision process is the one that most closely mimics the way clinical decisions are made--that is, certain weighting factors are assigned to the most important variables. The data base used in this study did not incorporate many pre-operative and intra-operative variables which one might suspect would influence recovery complications. However, it is of interest that many of the variables which were examined did not predict complications, e.g. ASA Physical Status, airway status, and degree of monitoring. The occurrence of recovery complications appears to be independent of these factors. However, with advance knowledge of the age alone, the recovery room administrator can now make a reasonable prediction about risk during recovery.

TABLE: RECOVERY COMPLICATIONS

Actual Group	No. of Cases	Predicted Group No	Yes
No	484	307 (63%)	177 (37%)
Yes	32	10 (31%)	22 (69%)

References.
1. Nie NH, Hull CH, Jenkins JG, et al: SPSS-Statistical Package for the Social Sciences, 2nd ed. New York, McGraw-Hill, 1975, pp 434-467
2. Goldman L, Caldera DL, Nussbaum SR, et al: Multifactorial index of cardiac risk in noncardiac surgical procedures. N Engl J Med 297:845-850, 1977