

TITLE: RENAL - RESPIRATORY INDEX FOR OUTCOME PREDICTION OF INTENSIVE CARE IN POSTOPERATIVE PATIENTS

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Introduction. There has been increasing interest in the development of a system to estimate the severity of illness and the prognosis of patients treated in intensive care units (ICU). It has been reported that the Acute Physiology Score (APS), a weighted sum of 34 variables commonly measured in an ICU, is useful in classifying ICU admissions.¹ During the evaluation of the APS, we noted that renal and respiratory function alone were also good predictors of outcome. This study was conducted to determine if combined renal and respiratory function could predict the outcome of intensive care and, if so, how sensitive it is compared to the APS.

Study 1

Methods. Study 1: During the period April 1982 - December 1983, 583 postoperative patients managed for more than 24 hours in the surgical ICU were studied. Renal transplant patients and those transferred following treatment in other ICUs were excluded. In all patients, 24-hour creatinine clearance (Ccr) was measured on the day of admission. The lowest PaO₂/FIO₂ ratio during the first 24 hours was obtained for each patient. Each Ccr and PaO₂/FIO₂ values were correlated with in-hospital outcome using the Point Biserial Correlation Method and two-predictor variable Discriminant Analysis was performed to find the relationship between in-hospital outcome and the two variables combined.

Results. Postoperative Ccr, which was not age-adjusted and PaO₂/FIO₂ ratio correlated significantly with in-hospital outcome in Point Biserial correlation test. (Table 1) Discriminant Analysis produced a discriminant function: $Y = 124 - 45 \text{ Log } X_1 - 0.087 X_2$, where Y represents the probability of death, tentatively named renal-respiratory index (RRI), X₁ is Ccr and X₂ is PaO₂/FIO₂ ratio. (Table 1)

Table 1: Point Biserial Correlation and Discriminant Analysis

	Correlation	p
Ccr	r _{pbi} = 0.49	< 0.0001
PaO ₂ /FIO ₂	r _{pbi} = 0.36	< 0.0001
RR Index	R = 0.54	< 0.0001

r_{pbi} Point Biserial correlation coefficient
R: Multiple correlation coefficient

Study 2

Methods. Study 2: In order to validate the RRI and to compare the predictability of the RRI with that of the APS, 125 consecutive patients managed for more than 24 hours in the surgical ICU from July 1981 to October 1981 were studied. RRI and APS were computed with the use of values already obtained for unrelated studies. Discriminant analysis was performed and total error rate of prediction was calculated. RRI was correlated with APS with the Pearson product-moment correlation method.

Results. Seventeen of the 125 patients died (13.6%), 12 during their ICU stay and 5 while still hospitalized following discharge from the ICU. Discriminant Analysis showed that Mahalanobis' distance, a measure of distance between survivors and deaths, was greater using the RRI than the APS. (Table 2) There was a good correlation between the two indices. (r = 0.69)

Table 2: Discriminant Analysis and Comparison

	Survivals (108)	Deaths (17)	D	Error rate
RR Index	15 ± 13	64 ± 34	2.83	8.8%
APS	8 ± 7	23 ± 9	1.69	11.2%

Values: mean ± SD, D: Mahalanobis' distance

The RRI was better able to discriminate ICU deaths from non-ICU deaths than was the APS. However, neither index was able to discriminate non-ICU deaths from survivors. (Table 3)

Table 3: Renal-Respiratory Index and APS of the 12 ICU deaths and the 5 non-ICU deaths

	ICU Deaths (12)	Non-ICU Deaths (5)	D
RR Index	79 ± 25	25 ± 17	2.2
APS	26 ± 7	15 ± 8	1.3

Values: mean ± SD

Discussion. This study demonstrates that the RRI, which uses only two variables, appears to be a better predictor of outcome in postoperative patients than the APS. This is an interesting finding, in view of the fact that there is a good correlation between the two indices. A further study of the patients' clinical course suggests that the APS may underestimate the severity of illness of postoperative patients as it does not account for the response to and the magnitude of preadmission treatment. For example, patients who undergo aggressive fluid and pharmacologic resuscitation following shock may show a low APS while the RRI shows a high probability of death. Neither index appears to be useful as a predictor of non-ICU deaths. The cause of death in these patients was not related to their ICU admission diagnosis.

Conclusion. The RRI appears to be a good predictor of outcome for postoperative patients managed in the ICU. Further study is warranted to determine 1) whether the RRI is useful in non-surgical and open-heart surgery patients and 2) how the RRI and the APS are related as predictors of outcome.

References.

1. Knaus WA, et al: Evaluating outcome from intensive care. Crit Care Med 10:491, 1982.