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ADMISSION SOURCE PREDICTS SURGICAL ICU OUTCOMES: IMPLICATIONS FOR TERTIARY REFERRAL CENTERS

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PURPOSE: Current benchmarking practices focus more on diagnosis and physiologic measures and less on response to therapy since measurements of the latter are difficult to obtain. Transfer to the ICU from another hospital is often an indication of a poor response to therapy. Transferred patients may not be as likely to respond to intensive care as patients admitted directly after an operation or from the emergency department (ER). Few previous studies have systematically evaluated the importance of this selection bias for ICU patients and none exist for a homogenous Surgical ICU (SICU) population. This study examined the independent influence of admission source on ICU patients' lengths of stay (LOS) and mortality rates.

METHODS: Data for 4,857 consecutive admissions from June 1995 to January 2000 were prospectively collected in an APACHE III clinical database for patients admitted to a tertiary care hospital SICU. Information regarding daily Acute Physiology Score (APS), diagnosis, treatment status, amount of time treated prior to ICU admission and admission source to the ICU, were compared using bivariate analysis. The independent influences of these predictors on ICU outcomes were evaluated using logistic regression.

RESULTS: Patients who were transferred to the SICU from another hospital compared to patients admitted directly to the ICU from the OR, ER or Floor, had higher admission APS (48 vs. 35), higher discharge APS (46 vs. 30), more comorbidities, longer ICU LOS (12 vs. 5 days), longer hospital LOS (20 vs. 17 days), and a greater than three-fold increased hospital mortality rate (27% vs. 8%). The results of the logistic regression analysis revealed that transfer status remained a significant independent predictor of poor ICU and hospital outcomes after controlling for all other variables (Table).

CONCLUSIONS: Controlling for lead-time bias, case-mix, comorbidities, and illness severity, revealed that a transfer from another hospital independently predicts poorer ICU outcomes. The current system of DRG-based reimbursement and case-mix adjusting by diagnosis or physiology alone may not identify patients who are less likely to respond to therapy. Academic and other referral centers may have worse than expected outcomes if they treat significant numbers of transferred patients.

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OUTCOME	TRANSFER PATIENTS*	P-VALUE
	Odds Ratio (95%,CI)	
ICU Mortality	1.7 (1.2-2.6)	<.001
Hospital Mortality	1.9 (1.1-3.2)	<.001
	% Increase in LOS (95% CI)	
ICU Length of Stay	44% (23%-61%)	<.001
Hospital Length of Stay	51% (37%-64%)	<.001

* Compared to patients directly admitted from the operating room or ER

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TITLE: PARTIAL PRESSURE OF END-TIDAL CO_2 IN THE ICU: *REEVALUATING OLD BELIEFS*

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With alveolar ventilation-to-perfusion abnormalities, as in acute respiratory distress syndrome (ARDS), alveolar deadspace volume increases resulting in large discrepancies between $PaCO_2$ and the partial pressure of end-tidal CO_2 ($PetCO_2$). Thus, the belief is $PetCO_2$ is a spurious predictor of $PaCO_2$ in critically sick, ventilator-dependent patients and should not be used. The purpose of this study was to evaluate the accuracy of $PetCO_2$ for predicting $PaCO_2$ in patients with ARDS connected to life-support ventilators.

Following IRB approval, 31 intubated adults (age: 59 ± 19, weight: 84 ± 18, gender: 22 males, 9 females) requiring ventilatory support, and diagnosed with ARDS for myriad reasons were studied. Patients received various combinations of intermittent mandatory ventilation, pressure support ventilation, pressure control ventilation, and positive end expiratory pressure. FIO_2 ranged from 0.30 to 1.0. Data from a combined pressure, flow, and carbon dioxide sensor positioned between the "Y" piece of the breathing circuit and endotracheal tube were directed to a respiratory monitor (COSMO +, Novametrix) that measured $PetCO_2$, the physiologic deadspace volume to tidal volume ratio (V_D/V_T), and a variety of ventilatory parameters. All subjects had arterial blood gases measured, were treated in the same SICU, and none were diagnosed with COPD. Data were analyzed using regression, unpaired t, and Wilcoxon ranked sum tests; alpha was set at 0.05 for statistical significance.

$PetCO_2$ was a very good predictor of $PaCO_2$ in subjects with a V_D/V_T ratio **less** than 0.50 (n = 20) (**r^2 = 0.91**) (Fig. 1). In subjects with a V_D/V_T ratio **greater** than 0.50 (n = 11), $PetCO_2$ poorly predicted $PaCO_2$ (**r^2 = 0.54**) (Fig. 2). Subjects with V_D/V_T ratios greater than 0.50 had significantly higher peak inflation pressures, ventilator rates, and $PaCO_2$ levels, and lower PaO_2/FIO_2 values (Table).

$PetCO_2$ accurately predicted $PaCO_2$ for the majority of patients with moderate forms of ARDS (65%). For those with more severe ARDS, requiring higher levels of ventilatory support and more compromised arterial gas exchange (35%), $PetCO_2$ did not accurately predict $PaCO_2$. Measuring $PetCO_2$, the V_D/V_T ratio and related ventilation data at the ***"Y" piece of the breathing circuit*** appear useful for monitoring and assessing ventilatory therapy for many ICU patients.

Table

	V_D/V_T	PIP	Ventilator Rate	$PaCO_2$	PaO_2/FIO_2
N = 20	.4 ± .08	33 ± 6	2.5 ± 1	38 ± 7	251 ± 75
N = 11	.6 ± .05*	41 ± 9*	10 ± 6*	52 ± 12*	200 ± 56*

*p < .05, mean ± SD

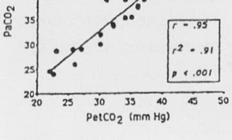

Figure 1

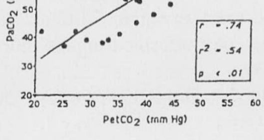

Figure 2