Lack of Influence of Gender on Outcomes of Mechanically Ventilated Medical ICU Patients*

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Study objectives: **Recent studies combining medical and surgical patients have suggested that mortality is higher for mechanically ventilated women than for men. This study was designed to determine whether there are gender-based differences in outcomes in mechanically ventilated medical ICU (MICU) patients.**
Design and setting: **Prospective observational study in an MICU of a tertiary-care academic medical center.**
Patients: **Five hundred eighty consecutive patients admitted to the MICU service and mechanically ventilated for a minimum of 12 h.**
Results: **There was no difference in overall hospital mortality rate (woman, 36.3%; men, 40.4%; $p > 0.2$). No differences in mortality rates were noted after stratification based on age, underlying comorbid condition, APACHE (acute physiology and chronic health evaluation) II score, indication for mechanical ventilation, or acute hepatic or renal failure. Using a multiple logistic regression model, gender was not independently associated with hospital mortality. No differences were found between men and women for a number of secondary outcomes, including likelihood of undergoing weaning trials, success of weaning trials, time between onset of mechanical ventilation and extubation, total time on mechanical ventilation, rate of unplanned extubations, need for reintubation or tracheostomy, or duration of MICU and hospital stay, after the onset of mechanical ventilation. The number and timing of orders written to withhold care were comparable between men and women.**
Conclusions: **Using univariate and multivariate analyses, we found no differences in hospital mortality rates between mechanically ventilated men and women. Differences in the process of care or gender-based treatment bias may explain previously reported differences in outcomes.**
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Key words: extubation; gender; ICU; mechanical ventilation; outcome; weaning

Abbreviations: APACHE = acute physiology and chronic health evaluation; CHF = congestive heart failure; f = frequency; F_{IO_2} = fraction of inspired oxygen; MICU = medical ICU; RR = relative risk; V_T = tidal volume

Based on studies in patients with either cardiac disease or those undergoing cardiothoracic or vascular surgery, there has been interest in the influence of gender on ICU outcomes.[1–4] More recently, this inquiry has been extended to differences in the outcomes for patients receiving mechanical ventilation. Kollef[5] noted an increased mortality rate for mechanically ventilated women that appeared attributable to differences in severity of illness or referral bias. Subsequently, in a study combining surgical and medical patients, Kollef et al[6] used multivariate analysis to show that female gender was independently associated with increased mortality. The relative differences detected were found to be greater for surgical ICU patients than for medical ICU (MICU) patients. The authors also noted that women were more likely to have withdrawal of support, raising the possibility that variability in the process of care may have existed. To further investigate this, we studied a number of

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outcomes in consecutive MICU patients who required ≥ 12 h of mechanical ventilation.

Materials and Methods

Patient Selection

Our hypothesis was that outcomes for mechanically ventilated men and women, in an MICU, would be similar if there were comparable degrees of severity of illness and if the process of care was equivalent. Therefore, we conducted a prospective observational study at a tertiary-care, university-affiliated teaching hospital (New England Medical Center). All patients who were admitted to the Medical ICU Service and who were intubated and mechanically ventilated for a minimum of 12 h were entered into the study. The MICU is a closed unit staffed by nine Pulmonary and Critical Care attending physicians with 24-h-a-day coverage provided by pulmonary and critical care fellows and internal medicine residents.

Data Collection

A member of the research team made daily rounds in the MICU and obtained clinical data. Initial clinical data that were recorded included age, gender, indication for mechanical ventilation, presence of significant chronic comorbid conditions, severity of illness scoring using the acute physiology and chronic health evaluation (APACHE) II, ventilator data, and arterial blood gas evaluation results. The initial postintubation chest radiograph was reviewed to note the positioning of the endotracheal tube. Subsequently, chest radiographs (and, if obtained, chest CT scans) were reviewed daily for the presence of barotrauma unrelated to central line insertion. Severity of illness scoring using APACHE II, arterial blood gas measurements, and measurement of the spontaneous breathing pattern (frequency [f]/tidal volume [VT] ratio) were recorded at the onset of weaning trials. The f/VT ratio was measured, using a spirometer (Wright respirometer; Ferraris, England), during the first minute of disconnection from the ventilator. The development of acute hepatic failure and acute renal failure was noted.

Outcomes

Patients were followed daily until hospital discharge. The principal study outcome was hospital mortality rate. Additional secondary outcome measures included the following: days in the ICU and days in the hospital *after* the initiation of mechanical ventilation; total duration of mechanical ventilation (including additional time resulting from reintubation); likelihood of undergoing weaning trials; time from onset of mechanical ventilation to initiation of weaning trials; total duration of weaning trials; need for reintubation within 72 h of extubation; occurrence of unplanned extubation; need for tracheostomy; and need for transfer to rehabilitation or chronic/subacute care unit. We also recorded the time and date when an order to withhold care was written.

Definitions

Indications for mechanical ventilation were the following: respiratory failure (from asthma, COPD, upper airway obstruction, pneumonia, acute lung injury, lobar collapse, pleural disease, interstitial lung disease, pulmonary hemorrhage, pulmonary vasculitis, pulmonary embolism, hypoventilation syndrome, respiratory muscle dysfunction, anaphylaxis, or aspiration); cardiac failure (from myocardial infarction/unstable angina, congestive heart failure, cardiogenic shock, cardiac arrest, pericardial disease, arrhythmia, or cor pulmonale); and other (acute renal failure, acute hepatic failure, sepsis, acidosis, hemorrhagic or hypovolemic shock, GI bleeding requiring transfusion, drug overdose, and acute CNS dysfunction, including seizure, cerebrovascular accident, hemorrhage, infection, or encephalopathy).

Chronic comorbid conditions included the following: active malignancy (untreated or currently undergoing therapy); cirrhosis (proven by biopsy or with evidence of portal hypertension); congestive heart failure (history of left ventricle ejection fraction ≤ 40%); COPD (compatible clinical history or FEV_1/FVC ratio < 0.70); chronic renal failure (long-term dialysis); diabetes mellitus (on either oral hypoglycemic agent or insulin); HIV (positive blood test for HIV); and organ transplantation (liver, kidney, bone marrow, or heart).

Organ failure included the following conditions: acute hepatic failure (bilirubin level, ≥ 5 mg/dL; international normalized ratio, ≥ 1.5) and acute renal failure (condition requiring dialysis, excluding long-term dialysis patients)

Malpositioning of the endotracheal tube was considered to be present if the tube was in the right mainstem bronchus, within 2 cm of the carina or above the thoracic inlet.

Barotrauma was defined as the presence of pneumothorax, pneumomediastinum, or subcutaneous air (unrelated to central line placement) noted either on chest radiograph or, if obtained, on chest CT scan.

Statistical Analysis

Continuous variables are reported as mean ± SD. Continuous variables were compared using an independent Student's *t* test for normally distributed variables and a nonparametric test (Wilcoxon rank sum test) for nonnormally distributed variables. For dichotomous variables, either a χ^2 test or a two-tailed Fisher's Exact Test was used. The primary analysis compared men and women. A secondary analysis compared hospital survivors and nonsurvivors. We subsequently performed a multiple logistic regression analysis with hospital survival as the dependent variable. Independent variables included those found to have a p value < 0.20 during univariate analysis, gender, and variables previously shown by multivariate analysis to be associated with mortality (*eg*, reintubation). A forward stepwise approach was used, with a value of 0.05 used as the limit for determining entrance or removal to or from the model. Assuming that approximately 60% of mechanically ventilated patients in our MICU are men (estimated mortality rate, 30%), a power analysis determined that 580 patients were required to have an 80% chance of finding an absolute mortality rate increase of 10% in mechanically ventilated women. All statistical analyses was performed using computer software (SPSS, version 6.1; SPSS Inc; Chicago, IL).

Results

The study population consisted of 330 men (57%) and 250 women (43%). Tables 1 and 2 show baseline characteristics of these two groups. No differences were found in age, indication for mechanical ventilation, or APACHE II scores. While similar percentages of men and women had diabetes mellitus, chronic renal insufficiency, chronic congestive heart failure, and organ transplantation, men were more likely to have active malignancy and COPD, and to

Table 1—*Characteristics Comparing Women and Men in Study Group**

Characteristics	Women	Men	p Value
No. of patients	250	330	
Age, yr	56 ± 18	57 ± 17	> 0.2
≥ 65 yr	90 (36)	128 (39)	> 0.2
Chronic comorbid conditions			
Active malignancy	43 (17)	82 (25)	< 0.05
Cirrhosis	44 (18)	45 (14)	0.19
Chronic renal failure	16 (6)	24 (7)	> 0.2
Diabetes	35 (14)	38 (12)	> 0.2
COPD	56 (22)	99 (30)	< 0.05
Chronic CHF	27 (11)	51 (15)	0.11
HIV	5 (2)	20 (6)	< 0.05
Organ transplantation	14 (6)	22 (7)	> 0.2

*Values given as No. (%) or mean ± SD. CHF = congestive heart failure.

be HIV positive. While no difference in the occurrence of acute renal failure was noted, acute hepatic failure tended to occur more frequently in women.

Women were significantly more likely to have the initial endotracheal tube malpositioned (Table 3). At the onset of mechanical ventilation, men tended to have a lower Pa_{O_2}/fraction of inspired oxygen (F_{IO_2}) ratio and pH. The incidence of barotrauma was low in both men and women. The groups were similar in both time to onset of and in duration of weaning trials. While APACHE II scores at weaning onset were comparable, women had a higher Pa_{O_2}/F_{IO_2} ratio and higher f/V_T.

No differences were found in the likelihood of undergoing weaning trials, the time between onset of mechanical ventilation and extubation, the total time on mechanical ventilation, the rate of unplanned extubations, the need for reintubation or tracheostomy (Table 4). As can be seen from Figure 1, there was no difference in overall hospital mortality rate (woman, 36.3%; men, 40.4%; $p > 0.2$). Similarly, no differences in mortality rate were noted after stratification based on age, APACHE II score, underlying comorbid condition, indication for mechanical ventilation, or acute hepatic or renal failure (Figs 1–3). Orders to withhold care were written in comparable percentages of men and women patients. Among those with such orders written, there were no differences in time from the onset of mechanical ventilation to the writing of the order or in the time from the writing of the order to time of death. The duration of ICU and hospital stays after the onset of mechanical ventilation and the likelihood of transfer to long-term or subacute care were comparable.

Tables 5 and 6 contrast data for hospital survivors and nonsurvivors. The overall mortality rate was 39%. Nonsurvivors had a higher APACHE II score and were more likely to have active malignancy, cirrhosis, HIV, and organ transplantation. Survivors were more likely to have COPD. Sepsis and acute lung injury were more likely to be present in nonsurvivors. Survivors were more likely to require mechanical ventilation because of an exacerbation of COPD, acute congestive heart failure, or drug overdose. Nonsurvivors were more likely to develop both acute hepatic failure and acute renal failure.

Using a multiple logistic regression model, higher APACHE II scores, the presence of chronic comorbid conditions (active malignancy, cirrhosis, and HIV), acute lung injury, sepsis, acute hepatic failure,

Table 2—*Severity-of-Illness Scoring, and Indications for Mechanical Ventilation and Acute Organ Failure**

Variables	Women	Men	p Value
No. of patients	250	330	
APACHE II	17 ± 7	17 ± 7	> 0.2
Indication for MV			
Respiratory failure	163 (65)	217 (66)	> 0.2
Acute lung injury	39 (16)	57 (17)	> 0.2
Pneumonia	73 (29)	109 (33)	> 0.2
COPD exacerbation	33 (13)	39 (12)	> 0.2
Cardiac failure	48 (19)	78 (24)	0.2
Myocardial infarction	21 (8)	31 (9)	> 0.2
CHF	39 (16)	54 (16)	> 0.2
Other	113 (45)	143 (43)	> 0.2
Sepsis	57 (23)	72 (22)	> 0.2
Drug overdose	17 (7)	26 (8)	> 0.2
Acute CNS disease	72 (29)	84 (25)	> 0.2
GI bleeding	26 (10)	37 (11)	> 0.2
Acute organ failure			
Acute hepatic failure	16 (6)	10 (3)	0.05
Acute renal failure	25 (10)	33 (10)	> 0.2

*Values given as No. (%) or mean ± SD. MV = mechanical ventilation. See Table 1 for other abbreviation.

Table 3—*Data Relating to Mechanical Ventilation Comparing Women to Men**

Data	Women	Men	p Value
Endotracheal tube malposition	56 (22)	32 (10)	< 0.001
Values at onset of MV			
F_{IO_2}	0.54 ± 0.22	0.57 ± 0.22	0.19
Pa_{O_2}, mm Hg	137 ± 88	132 ± 85	> 0.2
Pa_{O_2}/F_{IO_2}	262 ± 134	241 ± 124	0.06
Pa_{CO_2}, mm Hg	37 ± 12	38 ± 13	> 0.2
pH	7.41 ± 0.10	7.40 ± 0.10	0.07
Barotrauma	11 (4)	9 (3)	> 0.2
Time to weaning onset, h	100 ± 157	89 ± 102	> 0.2
Values at onset of weaning trials			
APACHE II	10 ± 5	11 ± 5	> 0.2
Pa_{O_2}/F_{IO_2}	318 ± 124	282 ± 92	< 0.01
f/V_T, breaths/min/L†	90 ± 43	53 ± 34	< 0.001
Duration of weaning trials, h	58 ± 146	55 ± 142	> 0.2

*Values given as No. (%) or mean ± SD. See Table 2 for abbreviation.

†Values were determined in 113 women and in 150 men.

Table 4—*Outcome Measures Comparing Women to Men**

Outcome Measures	Women (N = 250)	Men (N = 330)	p Value
Patients not undergoing weaning trials	62 (25)	89 (27)	> 0.2
Unplanned extubation	16 (6)	27 (8)	> 0.2
Never extubated	46 (18)	62 (19)	> 0.2
Patients undergoing weaning trials	188 (75)	241 (73)	> 0.2
Passed weaning trials, planned extubation	172 (69)	213 (65)	> 0.2
Unplanned extubation	12 (5)	22 (7)	> 0.2
Time to first extubation, h	156 ± 238	144 ± 207	> 0.2
Failed weaning trials, never extubated	4 (2)	6 (2)	> 0.2
Reintubation after planned extubation†	23 (9)	39 (12)	> 0.2
Tracheostomy	17 (7)	22 (7)	> 0.2
Total time on mechanical ventilation, h‡	196 ± 269	205 ± 267	> 0.2
Duration of ICU stay after onset mechanical ventilation, d	10.8 ± 12.9	11.2 ± 12.6	> 0.2
Duration of hospital stay after onset mechanical ventilation, d	18.0 ± 18.9	19.9 ± 19.8	> 0.2
Transferred to chronic or subacute care	54 (22)	85 (26)	> 0.2
Transferred while on mechanical ventilation	7 (3)	9 (3)	> 0.2
Hospital Nonsurvivor	91 (36)	133 (40)	> 0.2
Order written to WC	77 (31)	113 (34)	> 0.2
Hospital nonsurvivor with WC order§	62 (68)	96 (73)	> 0.2
Time between onset of MV and WC order, d	8.5 ± 13.2	9.6 ± 11.1	> 0.2
Time between WC order and death, d	2.4 ± 4.5	3.8 ± 4.5	> 0.2

*Values given as No. (%) or mean ± SD. WC = withhold care. See Table 2 for other abbreviation.
†Reintubation within 72 h of extubation.
‡Includes additional time on mechanical ventilation resulting from reintubation at any time during the hospitalization.
§Number in parentheses is percentage of women nonsurvivors or men nonsurvivors.

need for reintubation, and the absence of drug overdose were independently associated with hospital mortality (Table 7). As with the univariate analysis, gender was not found to be independently associated with hospital mortality.

Discussion

A number of previous studies have suggested increased mortality rates for critically ill women compared to critically ill men.[1–4,6] The majority of

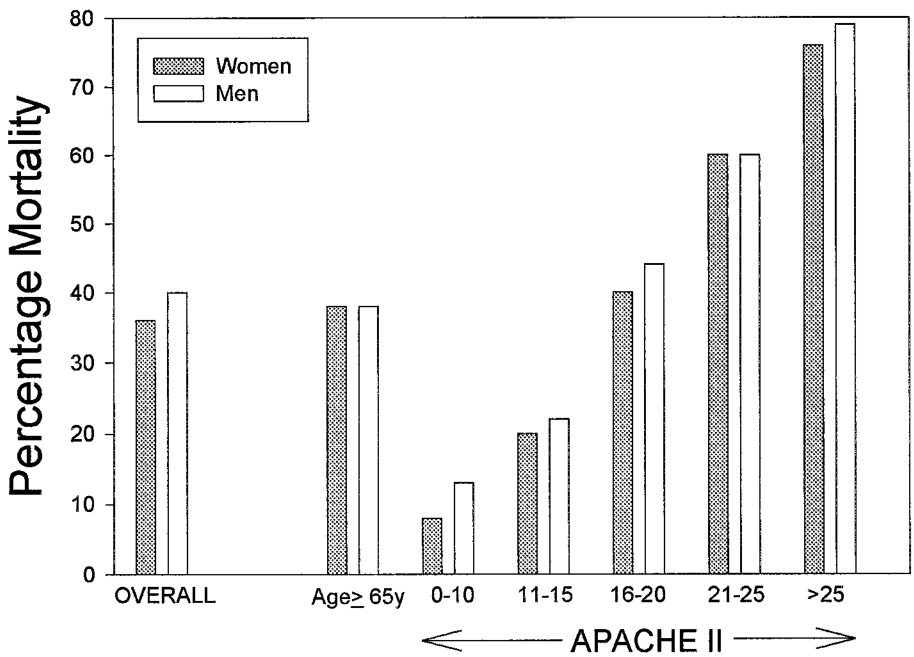

FIGURE 1. Comparison of hospital mortality rates for mechanically ventilated women and men, including overall mortality and stratification based on age and APACHE II scores. There was no difference in overall mortality rate or for mortality rates based on stratification.

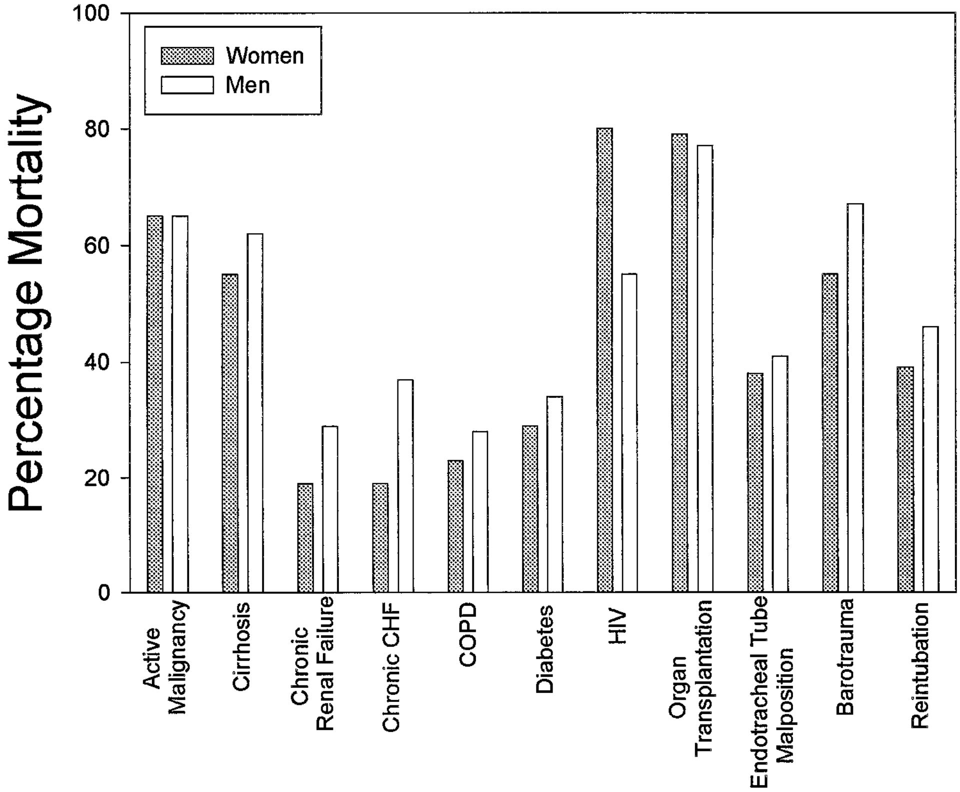

FIGURE 2. Comparison of hospital mortality rates for mechanically ventilated women and men, including stratification based on the presence of chronic comorbid conditions, endotracheal tube malposition, barotrauma, or the need for reintubation. There was no difference in mortality rates based on stratification except for a trend ($p = 0.09$) for chronic congestive heart failure (CHF).

these studies have been conducted in surgical patients, in mixed populations of ICU patients, or in those patients primarily having cardiovascular disease. Recently, rigorously conducted studies have questioned the validity of the findings among patients with cardiovascular disease. Koch et al[7] found that gender was not an independent risk factor for perioperative mortality when coronary artery bypass graft patients were stratified based on severity-of-illness scoring. Similarly, Coronado and colleagues[8] studied gender differences in hospital mortality rates in patients with acute cardiac ischemia in a large, multicenter, prospective study totaling nearly 11,000 patients. These authors found that trends for higher mortality in woman were attributable to older age, presence of diabetes, and higher Killip class on presentation. Kober et al,[9] studying approximately 7,000 Danish patients with acute myocardial infarction, found that, although female gender independently predicted short-term (6- and 30-day) mortality rates, the apparent increase in the long-term mortality rate was explained by the group's older age.

The issue of gender-based differences in outcomes for patients requiring mechanical ventilation has been indirectly explored in earlier reports. Studies examining mixed groups of surgical and medical patients with acute hypoxemic respiratory failure,[10] all patients ventilated for > 24 h,[11] or patients with acute respiratory failure[12] found no differences in outcomes when men were compared to women in univariate analysis. More recently, Kollef[5] studied referrals to a military hospital and found higher mortality rates for mechanically ventilated women. With multiple logistic regression analysis, controlling for severity of illness and organ dysfunction, this independent effect of gender disappeared. In a subsequent study of combined MICU and surgical ICU patients in two tertiary-care university hospitals, Kollef et al[6] found higher mortality rates for women that persisted after controlling for age, ARDS, APACHE II scores, and the number of dysfunctional organs. The authors controlled for some (*eg*, COPD and diabetes) but not all (*eg*, chronic congestive heart failure, chronic renal failure, cirrhosis, active malignancy, HIV, and organ transplantation) of the chronic comorbid conditions that may impact survival.

In contrast, both prior to and after controlling for a wide array of chronic comorbid conditions, we found gender not to be an independent predictor of

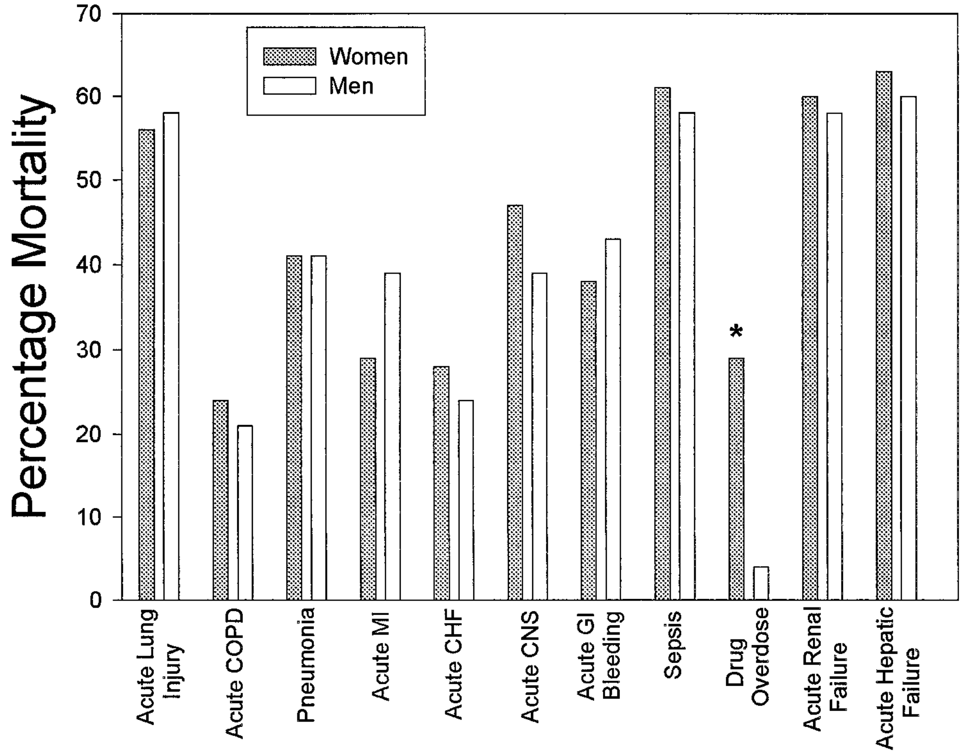

FIGURE 3. Comparison of hospital mortality rates for mechanically ventilated women and men, including stratification based on indication for mechanical ventilation and acute organ failure. There was no difference in mortality rates based on stratification except for the category of drug overdose (* $p < 0.05$). MI = myocardial infarction. See Figure 2 for other abbreviation.

survival for mechanically ventilated MICU patients. In our multivariate model, we controlled for age, severity-of-illness scoring, chronic comorbid conditions, and indications for mechanical ventilation (*eg*, acute lung injury and sepsis). Although we did not use the organ system dysfunction score used by Kollef et al,[6] we did control for important extrapulmonary organ failure, including acute hepatic failure and acute renal failure.

A number of explanations have been offered for possible differences in mortality rates between men and women, including the following: referral bias; gender-based differences in physiology; hormonal or immunologic distinctions; or treatment bias.[3–6,13–18] Kollef et al[6] found that the relative risk (RR) was higher for women in the surgical ICU (RR, 2.3) than for those in the MICU (RR, 1.3). In addition, these authors noted that male nonsurvivors were more likely to die while still on mechanical ventilation and were less likely to have mechanical ventilation actively withdrawn. Our finding of equivalent outcomes could relate to the fact that men were not treated as aggressively as women. The analysis of withholding-of-care rates, time to withholding of care, time from withholding of care to time of death, and severity-of-illness scoring clearly shows that this is not the case. That is, when the process of care is uniform in an MICU, the outcomes for men and women are the same. The implications are clearly very important. Critical care physicians who find disparities in outcomes for MICU patients need to

Table 5—*Baseline Characteristics Comparing Survivors and Nonsurvivors**

Characteristics	Survivors	Nonsurvivors	p Value
No. of patients	356	224	
Men	197 (55)	133 (59)	> 0.2
Women	159 (45)	91 (41)	> 0.2
Age, yr	57 ± 17	57 ± 17	> 0.2
Age ≥ 65 yr	135 (38)	83 (37)	> 0.2
Chronic comorbid conditions			
Active malignancy	44 (12)	81 (36)	< 0.00001
Cirrhosis	37 (10)	52 (23)	< 0.0001
Chronic renal failure	30 (8)	10 (4)	0.07
Diabetes	50 (14)	23 (10)	0.19
COPD	114 (32)	41 (18)	< 0.01
Chronic CHF	54 (15)	24 (11)	0.15
HIV	10 (3)	15 (7)	< 0.05
Organ transplantation	8 (2)	28 (13)	< 0.00001

*Values given as No. (%) or mean ± SD. See Table 1 for abbreviation.

Table 6—*Severity-of-Illness, Indications for Mechanical Ventilation and Acute Organ Failure Comparing Survivors to Nonsurvivors**

Variables	Survivors	Nonsurvivors	p Value
No. of patients	356	224	
APACHE II	14 ± 6	21 ± 6	< 0.001
Indication for MV			
Respiratory failure	224 (63)	156 (70)	< 0.05
Acute lung injury	41 (12)	55 (25)	< 0.0001
Pneumonia	107 (30)	75 (33)	> 0.2
COPD exacerbation	56 (16)	16 (7)	< 0.01
Cardiac failure	83 (23)	43 (19)	> 0.2
Myocardial infarction	34 (10)	18 (8)	> 0.2
CHF	69 (19)	24 (11)	< 0.01
Other	153 (43)	103 (46)	> 0.2
Sepsis	52 (15)	77 (34)	< 0.00001
Drug overdose	37 (10)	6 (3)	< 0.001
Acute CNS disease	89 (25)	67 (30)	0.17
GI bleeding	37 (10)	26 (12)	> 0.2
Acute organ failure			
Acute hepatic failure	10 (3)	16 (7)	< 0.05
Acute renal failure	24 (7)	34 (15)	< 0.001
Endotracheal tube malposition	54 (15)	34 (15)	> 0.2
Barotrauma	8 (2)	12 (5)	< 0.05
Reintubation	35 (12)	27 (12)	> 0.2

*Values given as No. (%) or mean ± SD. See Tables 1 and 2 for abbreviations.

look carefully at whether differences in the process of care or gender-based treatment biases are present. Furthermore, our findings should provide new impetus to address the surgical ICU experience to determine whether true physiologic variability or disparity in the process of care explain gender-based differences in outcomes.

Our findings confirm previous observations that women were more likely to experience malpositioning of the endotracheal tube at initial intubation.[19] This finding had no effect on mortality, most likely because of rapid detection from routine postintubation radiographs and timely repositioning of the endotracheal tubes. Consistent with previous studies, women had a higher f/VT ratio than men, although differences in duration or success of weaning trials were not noted.[20,21] We speculate that if weaning or extubation had been systematically delayed because of an elevated f/VT ratio, women would have been disproportionately subjected to needlessly prolonged mechanical ventilation and a worse outcome.

The gender-based differences in mortality rates for patients with long-term congestive heart failure and drug overdose deserve further comment. The difference in mortality rate for the former group is explained by the fact that men in that group were more likely to have underlying active malignancy (15/51 men vs 2/27 women; $p < 0.05$) and tended to be intubated with an acute myocardial infarction (13/51 men vs 3/27 women; $p = 0.11$). The difference in outcome for the drug overdose subgroup is attributable to the distribution of overdose type. Specifically, 68% of men, compared to just 30% of women, overdosed on alcohol, narcotics, or sedatives. Only 1 of 30 such patients died. In contrast, five of six acetaminophen overdoses (all complicated by hepatic failure) occurred in women, two of whom died. Among other sources of overdose (theophylline, cocaine, calcium channel blockers, anticonvulsants, and tricyclic antidepressants), the mortality rates for men and women were similar (1/11 men vs 2/11 women).

Table 7—*Results of Multiple Logistic Regression Analysis Demonstrating Factors Independently Associated With Hospital Mortality*

Factors	Adjusted OR	95% CI	p Value
Acute lung injury	1.88	1.43–2.48	< 0.05
APACHE II	1.16	1.14–1.18	< 0.0001
Active malignancy	4.04	3.13–5.22	< 0.0001
Acute hepatic failure	6.24	3.54–11.00	< 0.01
Cirrhosis	2.68	2.02–3.57	< 0.001
Drug overdose	0.30	0.17–0.54	< 0.05
HIV	4.44	2.67–7.39	< 0.01
Reintubation	1.96	1.41–2.72	< 0.05
Sepsis	2.16	1.58–2.78	< 0.01

*OR = odds ratio; CI = confidence interval.

In conclusion, among MICU patients requiring mechanical ventilation, we found no difference in hospital mortality rate between men and women. Previously reported differences may have been related to the influence of data from surgical patients in the study cohort. Our findings suggest that differences in the process of care or gender-based treatment bias may explain previously reported differences in outcomes.

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