

Mechanical ventilation and mobilization: comparison between genders

CHRISTIANE RIEDI DANIEL, MSc¹*, CARLA ALESSANDRA DE MATOS, PT²,
JESSICA BARBOSA DE MENESES, PT², SUZANE CHAVES MACHADO BUCOSKI, PT²,
ANDERSOM RICARDO FRÉZ, MSc¹, CINTIA TEIXEIRA ROSSATO MORA, PT³, JOÃO AFONSO RUARO, PhD¹

¹) Department of Physical Therapy, Universidade Estadual do Centro-Oeste: Rua Simeão Camargo Varela de Sá, 03, Vila Carli Guarapuava, Paraná 85040480, Brazil

²) Faculdade Anglo-Americano, Brazil

³) Hospital Ministro Costa Cavalcanti and Faculdade Anglo-Americano, Brazil

Abstract. [Purpose] To investigate the impact of gender on mobilization and mechanical ventilation in hospitalized patients in an intensive care unit. [Subjects and Methods] A retrospective cross-sectional study was conducted of the medical records of 105 patients admitted to a general intensive care unit. The length of mechanical ventilation, length of intensive care unit stay, weaning, time to sitting out of bed, time to performing active exercises, and withdrawal of sedation exercises were evaluated in addition to the characteristics of individuals, reasons for admission and risk scores. [Results] Women had significantly lower values APACHE II scores, duration of mechanical ventilation, time to withdrawal of sedation and time to onset of active exercises. [Conclusion] Women have a better functional response when admitted to the intensive care unit, spending less time ventilated and performing active exercises earlier.

Key words: Hospital, Intensive care units, Physical therapy modalities

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INTRODUCTION

The improvement of practices in intensive care units (ICUs) has led to a decrease in the number of deaths and increasing numbers of patients who are discharged from these services. Individuals who remain in the ICU for prolonged periods can have severe muscle weakness, which can lead to functional dependency¹). This weakness is compounded by the use of mechanical ventilation (MV) which, although essential for the reversal of respiratory dysfunction, contributes to deconditioning due to the need for sedation and limitation of movement. Other factors that may contribute to weakness are the use of corticosteroids, neuromuscular blockers, and delirium^{2, 3}). Physical deconditioning occurs differently between genders⁴), but there are no published studies that have investigated this in patients who have been mechanically ventilated in an ICU.

It is recommended that prevention and management of acquired muscle weakness be routine in the ICU. Early mobilization plays a key role in the functional recovery of individuals treated in an ICU, enabling the negative impact of neuromuscular patients undergoing MV to be minimized

or even reversed. Processes involved in functional mobility such as rolling over, sitting, standing, and walking are consolidated and strengthened during physiotherapy⁵). Whole-body rehabilitation has been found to be safe and well-tolerated, and results in a better functional outcome at the time of hospital discharge, a shorter duration of delirium, and more ventilator-free days than standard care^{1, 3}). An assessment of activities of daily living, a useful indicator of the discharge destination of patients undergoing acute rehabilitation, showed that these were also improved after whole-body rehabilitation⁶). However, the procedures for and effects of such interventions are not well established in the literature. Thus, the aim of this study was to survey the mobilization of patients admitted to a general ICU and compare the survey results between genders.

SUBJECTS AND METHODS

This was a retrospective cross-sectional study in which we investigated the practice of mobilization of patients admitted to the ICU of the Hospital Ministro Costa Cavalcanti in Foz do Iguaçu (Paraná, Brazil). The study was approved by the Ethics Committee of the Faculdade Assis Gurgacz (rolling number 042/2013). The study protocol adhered to Brazilian laws and guidelines concerning human research.

The medical records of all patients aged >18 years admitted to the ICU and mechanically ventilated between January and July 2013 were included, regardless of clinical diagnosis. Records with incomplete data, patients admitted for less than 72 hours, and those of patients who required more than

*Corresponding author. Christiane Riedi Daniel (e-mail: criedi@unicentro.br)

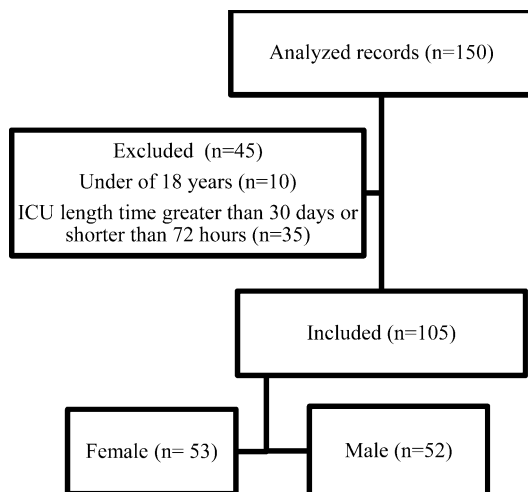


Fig. 1. Flowchart of patient eligibility

30 days of hospitalization were excluded because it was difficult to account for confounding variables in these groups.

In total, 150 records were identified, of which 105 met a set of predefined criteria (Fig. 1).

With regards to the hospital records, sex, clinical diagnosis, specialty, demographic characteristics, time required before the patient sat out of bed, time to the first withdrawal of sedation, time taken to be able to perform active exercises, the use and weaning of MV, and the length of ICU stay, comorbidities, the Acute Physiology and Chronic Health Evaluation II (APACHE II) mortality score, and hospitalization outcomes for each patient were recorded⁷⁾.

The primary endpoint of the study was the time interval need to be able to perform active exercises out of bed while seated. The secondary outcomes were time to the withdrawal of sedation, duration of MV, duration of weaning from MV, and hospitalization outcome (i.e. discharge, death, transfer, or long-term hospitalization). The tertiary outcomes were comorbidities, APACHE II score, and anthropometric data.

All parameters were compared between males and females. Data normality was determined using the Kolmogorov-Smirnov test for sample characterization. Data that were normally distributed (age, weight and BMI) were compared using t-tests for unpaired samples. For comparisons of nonparametric data, the Mann-Whitney test was used. The analysis of the specialties and the type of procedure according to gender was performed using the χ^2 test. After analyzing the results, we decided to perform a multiple regression to investigate the independent variables (data from mechanical ventilation and time of sedation) relationships with the APACHE II score. GraphPad InStat version 3.4 was used for all statistical analyses, with a significance level of $p < 0.05$.

RESULTS

The characteristics of individuals according to gender are shown in Table 1. Notably, a significant difference in APACHE II scores was observed between the two gender groups, wherein men had a higher mean APACHE II score

Table 1. Characteristics of subjects by gender

Variables	Male	Female
Age (years)	60.6 ± 16.3	61.0 ± 17.9
Weight (kg)	81.0 ± 28.4	66.6 ± 20.1*
Height (cm)	169.4 ± 8.3	156.8 ± 22.5*
BMI (kg/m ²)	27.0 ± 7.6	25.8 ± 8.4
Cause of intubation		
Respiratory failure	17 (33%)	18 (34%)
Coma	8 (15%)	4 (8%)
Surgical procedures	19 (37%)	25 (49%)
Hemodynamic instability	4 (8%)	4 (8%)
APACHE II	23.1 ± 9.1	12.3 ± 11.3*
APACHE %	46.1 ± 24.9	20.1 ± 23.4*
Procedure type		
Medical	22 (42%)	28 (55%)
Surgical	31 (58%)	23 (45%)
Specialty		
Neurology	8 (15%)	10 (19.2%)
General surgery	12 (24%)	14 (26%)
Respiratory	6 (11%)	7 (13.5%)
Oncology	14 (26%)	17 (32.7%)
Internal medicine	3 (5%)	1 (1.9%)
Others	10 (16%)	2 (5.8%)
Medications		
Corticosteroids	9 (17.3%)	14 (26.4%)
Neuromuscular blocker	0	1 (1.9%)
ICU outcomes		
Discharge	27 (51.9%)	23 (43%)
Death	22 (42.3%)	28 (52.9%)
Transferred	2 (3.8%)	1 (1.9%)
Hospitalized	1 (1.9%)	1 (1.9)
Associated disease		
Diabetes	7 (13.5%)	9 (17.0%)
Hypertension	14 (26.9%)	16 (30.2%)
Others	10 (19.2%)	14 (26.4%)

*Statistically significant; BMI: body mass index; ICU: intensive care unit; APACHE II: Acute Physiology and Chronic Health Evaluation II

than women.

Means values of the time-associated outcome variables for each gender group are reported in Table 2 together with the gender comparison statistical test results.

When performing multiple regression (R^2) analysis of the independent variables with the APACHE II scores, 66.2% ($p < 0.001$) of the APACHE II score of women was explained by withdrawal of sedation, and for men, 41.5% ($p = 0.047$) was explained by the time taken to be able to sit out of bed.

DISCUSSION

The impact of neuromuscular disorders of critically ill patients in the ICU have been carefully researched. These dysfunctions, depending on their severity, can become persistent and impact the quality of life of these individu-

Table 2. Comparison between time-related variables of the ICU

Variables	Male	Female
Duration of ICU stay (days)	8.2 ± 5.9	6.7 ± 5.0
MV duration (days)	6.7 ± 5.5	4.8 ± 4.4*
Weaning duration (days)	2.2 ± 3.9	1.6 ± 3.6
Time to sitting out of bed (days)	5.0 ± 6.8	3.1 ± 4.1
Time to withdrawal of sedation (days)	3.6 ± 2.3	2.0 ± 2.1*
Time to onset of active exercises (days)	5.7 ± 5.9	3.1 ± 4.0*

*Statistically significant. ICU: intensive care unit; MV: mechanical ventilation

als after their discharge⁸). In this study, we found that men required significantly more time than women to be removed from MV, to be withdrawn from sedation, and to be able to perform active exercises. There are conflicting results in the literature regarding gender differences in ICU outcomes. Guidry et al.⁹ reported that the relationship between gender and ICU outcomes was related to underlying disease processes. They suggested that women who suffer trauma have a higher survival rate than men, a result which is not seen in other pathologies. In our study, although the men presented with significantly higher APACHE II scores than women, they had similar mortality rates.

In contrast, Combes et al.¹⁰ found that women had a greater propensity to develop nosocomial infections, thereby increasing their ICU mortality rate, but they showed no significant difference in duration of MV. The present study did not investigate the development of infections, but a longer duration of MV was observed in male subjects.

Schoeneberg et al.¹¹ found a higher mortality rate among women during the first days of hospitalization, but observed that women responded better than men over prolonged hospitalization periods. These findings are similar to those observed in this study, in which women were found to have shorter MV times, in addition to earlier withdrawal of sedation and ability to perform active exercises, which suggests a better response to the critical event of hospitalization.

In this study, the length of time that women remained sedated was shorter than that of men. It is important that administration of sedatives be controlled to minimize the incidence and severity of delirium and encourage active exercises¹². However, the precise time when sedation should be weaned, or the implementation of daily interruption of sedation protocols, remains controversial. Certain barriers need to be overcome, such as optimization of analgesia, improved communication between staff, and adherence to evidence-based protocols. Hughes et al.¹³ have shown that sedation protocols are safe and improve patient outcomes when correctly implemented. Robinson et al.¹⁴ also reported that duration of MV and hospital stay were both reduced with early withdrawal of sedation. The present study showed that women who received early withdrawal of sedation also required shorter-duration MV. A similar finding was reported by Aday et al.¹⁵, who observed a beneficial effect of sedation withdrawal on MV duration but not on length of stay in the ICU.

Rehabilitation of ICU patients is necessary and must involve a multidisciplinary team to be effective¹⁶. Reha-

bilitation is considered safe and is well-tolerated by patients, as reflected by a better functional outcome at discharge, decreased delirium, and an increased number of days without MV¹. Furthermore, mobilization encourages intestinal motility in patients who are bed-bound¹⁷. It also redistributes pressure to different parts of the body surface and should be considered as a preventive measure against the development of pressure sores¹⁸.

Balas et al.¹⁹ argued for the implementation of early mobilization protocols. They found that the implementation of one such protocol, consisting of awakening and breathing coordination, delirium monitoring/management, and early exercise/mobility, resulted in an increase in the proportion of patients (from 48% to 66%) who were able to leave their beds while in the ICU. Pohlman et al.²⁰ demonstrated that early physical and occupational therapy (1.0–2.1 days after intubation) was feasible for ICU patients with MV. With their therapy protocol, free mobility in bed, transfer from bed to chair, standing, and walking were achieved in 69%, 33%, 33%, and 15% of the therapy sessions, respectively. Moreover, this strategy decreased the duration of MV by approximately 50%. Additionally, similar to the present study, Needham et al.¹ demonstrated that implementation of an early mobilization increased the proportion of patients who were able to leave their beds and perform active exercises from 56% to 78%.

Nydahl et al.²¹ investigated the mobilization profile of ICU patients in Germany without an early mobilization protocol, and found that only 24% of patients on MV, and 8% with an endotracheal tube were mobilized out of bed. Although this study did not follow an early mobilization protocol, 43% of women and 45% of men were able to sit in a chair and conducted exercises actively. One way to systematize the mobilization of individuals who require MV in the ICU is the development of early mobilization protocols to improve the functional status of these patients.

This study was limited in that it was a retrospective analysis of a series of patients from a single hospital, which limits the generalizability of the results.

In conclusion, women generally have a better functional response when admitted to the ICU, as they spend less time in the unit and are able to perform active exercises earlier. These differences from men may be influenced by the rapid withdrawal of sedation, as reflected by shorter durations of mechanical ventilation. The results of our study indicate the necessity to consider the gender in propositions of mobilization protocols for ICU patients.

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