115 - CRITICAL PATIENTS AND AEROBIC ACTIVITY: AN ANALYSIS OF HEMODYNAMIC VARIABLES

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INTRODUCTION

The Intensive Care Unit (ICU) performs a crucial role in the survival of critically ill patients, and has the objective focused on the recovery or maintenance of their physiological functions. In this context, several minor changes can be manifested, among which we can highlight immobilization 1.

The immobilization caused by the hospital bed reduces glycogen and triphosphate adenosine (ATP); muscular endurance, which may compromise blood irrigation with consequent decrease of oxidative capacity, reduction of muscular strength and torque, associated with lack of coordination due to generalized weakness, contribute to muscle fiber atrophy Type I and II, which results in poor quality of movement and impairment of ventilation weaning 1. Thus the immobility time will dictate the severity of contractile dysfunction by changes in the intrinsic properties of the muscle fibers 2.

In addition to the immobilization, which causes muscle atrophy through disuse, muscle weakness acquired in the ICU, could be caused by myopathy or polyneuropathy of critical patients. As an alternative of prevention and treatment of these neuromuscular diseases physical therapy has been defended through programs of precocious mobilization of critically ill patients 3 Physical training has been increasingly recognized as an important component on the care of critical patients by providing improvement in pulmonary function, muscle atrophy and functional independence, accelerating the recovery process and thus shortening VM and permanency at the ICU. Physical training has been increasingly recognized as an important component on the care of critical patients by providing improvement in pulmonary function, muscle atrophy and functional independence, accelerating the recovery process and thus shortening VM and permanency at the ICU 2.

In this regard, it becomes necessary to the current professional practice to understand which way the performance of aerobic activity in critically ill patients may interfere in the hemodynamic responses and improvement of functional independence. This study aimed to evaluate the responses of hemodynamic variables and volumetry of the lower extremities in critical patients undergoing physical training in the ICU.

METHODOLOGY

This research of qualitative nature, study case type 4, evaluated critical patients of both genders, for convenience in the adult ICU of the Santa Cruz Hospital. We included 05 critical patients with a prescription of physical therapy admitted at the IC of the Santa Cruz Hospital. Of the individuals included, 03 were excluded because of the stopping in the following of the activities due to early discharge from the ICU. Duly approved by the Ethics Research Committee of the University of Santa Cruz do Sul (UNISC) protocol number 2735/10.

The patients' clinical data were collected from the medical records and, after clinical evaluation the individuals were submitted to the research protocol that was characterized by sequential 05 sessions of aerobic exercise training on lower extremity. A horizontal and electric portable Cycloergometer, Paradigm ® brand and active cycle model was used. The speed of 27rpm was utilized, being the minimum speed of this cycloergonometer during 20 minutes continuously.

The interventions were associated with physical therapy in the ICU, afternoon shift, previous conventional physiotherapy performed by physical therapists from the hospital. The variables analyzed in the basal state, rest, during exercise and immediately after finishing each session of aerobic exercise were: blood pressure (BP), heart rate (HR), respiratory rate (RR), oxygen saturation (SpO2). For this we used the cardio-oxymetric monitoring system and the control sheet of the patients available at the border of each bed. We also checked each day of intervention measures such as hydric balance, muscle girth of both lower limbs at 10 and 20 cm of the knee having as reference the knee joint line and the method of Figure 8, to measure accurately the edema volume. 5,6. Rresults were organized in the researcher's own binder and after transcribed into worksheets at Microsoft Office Excel 2007 version and presented in tables and graphs with subsequent analysis and discussion of them both qualitatively.

RESULTS AND DISCUSSSION

The study included 02 patients diagnosed with traumatic brain injury, male, age 56 and 31 years, sedated (Ramsay Scale 6:05) without using vasopressor, Adult hospitalized at the ICU unity of Santa Cruz Hospital (HSC).

The clinical characteristics of the patients are arranged in Table 1.

Table 1: Clinical characteristics of the patients participating of the study.

Characteristics	Patient A	Patient B
Gender	Male	Male
Age	56 years	31 Years
Diagostic	Severe craneoencephalic injury TBI + craniotomy	Craneoencephalic injury
Previos time of permanency in the ICU*	2 days	4 days
Ramsay Scale	6	5
Glasgow Scale	3	3
Verbal Response	1	1
Motor Response	1	1
Oclar Opening	1	1
Mechanical Ventilation	Yes	Yes
Ventilatory Modality in the evalation day	Controlled pressure	Controlled pressure
Indication of respiratory and motor physiotherapy	Yes	Yes

Source: Survey data 2011.
* Time in the ICU before the beggining of data collecting.

The results for the hydric balance and thigh perimeter of the lower limbs are arranged in Table 2.

Table 2- Hydric balance and Perimetry of the thigh and foot of the lower extremities.

Patient A							
Session	**HB**	**P10cmL**	**P20cmL**	**A8L**	**P10cmR**	**P20cmR**	**A8R**
1st	-1321	35	38	50	33	39,5	39
2nd	-370	34,5	37	51	34,5	40	51,5
3rd	119	34,5	39	50	33,5	40	48,5
4th	166	36	40	50,5	35,5	41	49,5
5th	564	37	45	51	36	43	51
Patient B							
Session	**HB**	**P10cmL**	**P20cmL**	**A8L**	**P10cmR**	**P20cmR**	**A8R**
1st	527	52	60	63	50	58	67
2nd	475	49	57	58	48	58	64
3rd	237	48	53	57	45	55	59
4th	194	46	55	57	42	52	58
5th	-250	44	52	55	43	51	56

Source: Survey data 2011.
HB= Hydric Balance
P10cmL= Perimetry at 10cm above the knee joint line at the right(R) and left(L) side
P20cmL= Perimetry at 20cm above the knee joint line at the right(R) and left(L) side
A8L= Ankle measure in eight at the left (L) side

The results in Table 2 enables us to infer that the larger or smaller circumference of the lower extremities, which quantitatively reflect the lower limb edema, follows proportionality the fluid balance. It is observed that the lower the hydric balance is, lower is the lower extremities edema and vice versa, in both types of perimeter performed here.

This may explain the difference found between patient A and patient B, namely the patient A has no edema in the first day of physical training, considering this individual with a negative fluid balance (FB). A negative fluid balance in patients with severe TBI and intracranial hypertension, is a consequence of the treatment based on the use of diuretics, when performing decompressed craniotomy for correcting intracranial hypertension7.

The potentially beneficial effects of early mobilization are related to the theory of the calf muscle pump and muscle training. Exercise increases muscle tone of the lower limbs and, consequently, during muscle contraction, there is an increase in the ability to eject, facilitating venous return, which in turn reduces the hydrostatic pressure gradient responsible for edema formation, and improves muscular perfusion increase in venous return enhancing their action. 8,9.

The results pertinent to the hemodynamic variables are listed in Table 3.

Table 3- Hemodynamic variables

Patient A						
	OB	**OR**	**1`**	**5`**	**20`**	**5P**
PAS	115,6±7,40	115,6±3,44	113,4±4,16	117,4±6,35	120,4±9,18	118,8±5,26
PAD	70,8±7,12	74,4±2,88	72,6±2,41	75,4±4,83	71±6,08	74,8±4,09
HR	96,8±9,42	98,6±16,49	103,4±11,55	104,4±10,60	110,4±11,93	106,8±16,85
RR	21,6±7,64	29,6±11,93	30,8±11,8	34,2±3,42	34,6±1,14	30,2±3,96
SpO2	97,8±1,30	97,2±1,10	96,6±1,14	97,4±0,89	96,8±1,10	97,6±0,55
Patient B						
	OB	**OR**	**1`**	**5`**	**20`**	**5P**
PAS	113±8,37	119,4±3,97	120,6±7,20	116,6±6,15	119,6±7,30	114±4,69
PAD	70±7,91	73,8±7,29	74,2±5,31	73,4±4,77	78±5,70	76,6±4,22
HR	94,2±8,53	90,4±4,28	90,6±1,67	92,8±5,22	92,4±3,51	99,4±14,72
RR	21,8±2,28	24,8±4,76	28,6±4,98	27,8±3,70	28,2±6,02	25,2±3,27
SpO2	95,2±3,11	97,2±0,84	97,2±1,30	97,2±1,10	96,7±0,55	97,2±0,84

Source: Survey data 2011.
Values expressed in average ± standard deviation.
OB- Basal vital signs (first verification of the morning shift).
OR= Vital signs of the patient in rest.
5P= five minutes following the exercise protocol.

The results pertaining to HR and RR during the physical training were characterized in ascending order the 1st, 5th and 20th minute when compared to resting values, declining at year end but without return to baseline. The SpO2 remained stable during physical training. Since the graphical representation of the SBP and DBP shows that patients showed a divergent behavior in the 1st minute of exercise training for PAS and throughout AD training.

The physiological effects of exercises in healthy individuals can be classified into immediate acute, later acute and chronic. Acute effects occur in direct association with the workout; the acute effects are immediate, such as: elevated heart rate, pulmonary ventilation and sweating; since later acute effects occur within the first 24 or 48 hours following workout and can be identified in a slight reduction of blood pressure, especially in hypertensive patients, on the plasma volume expansion, improvement of endothelial function and the potentiation of the action and increased insulin sensitivity in the skeletal muscles 10,11,12.

On the other hand the aerobic exercise in healthy individual, as the contractions are followed by joint movements, there is not a mechanical obstruction of blood flow, so that in this type of exercise is also observed increase of sympathetic nervous activity. In response to the increase in sympathetic activity, there was an increase in the heart rate, stroke volume and cardiac output. Furthermore, production of metabolites on the muscle promotes vasodilation on active muscles, causing reduction in peripheral vascular resistance. Thus, during aerobic exercise there is an increase in systolic and diastolic maintenance or reduction 13.

According to PERHONEN et al. patients in bed have reduced cardiovascular performance, increased blood pressure and increased blood viscosity and even healthy individuals exhibit alterations in cardiac function after a period of six weeks of immobilization. The authors suggest that this occurs due to the physiological adaptation to reduced load and myocardium work. The increased coagulability and blood stasis resulting from the absence of pumping muscles, leads to a further increased risk of edema and thromboembolism complication in the lower extremities14.

Studies that have investigated the hemodynamic changes occurred in critically ill patients undergoing aerobic activity, published so far, refers particularly to the safety margin without placing the patient at risk. The first randomized clinical trial to study the use and effectiveness use of an cycle ergometer in critical patients was published by Gosselink et. al 2009, where the authors highlighted that regular daily exercise session with a cycle ergometer is feasible, safe, and should happen very early on

during ICU stay. The intervention improved functional exercise capacity, muscle strength, and anticipated hospital discharge in patients who participated in the study sample15.

PERME e CHANDRASHEKAR (2010) in their article "Early mobility and Walking program for Patients in intensive Care units: creating a Standard of care" suggest guidelines for a program of early mobilization in critical patients, dedicated to the ICU team. It is divided into four phases where each phase includes guidance on positioning, therapeutic exercises, transfers, deambulation and duration and frequency of mobilization sessions. Moreover, the criteria to advance to the next stage are provided. The use of this program requires a collaborative effort between members of the multidisciplinary team in order to coordinate care and provide for security mobilization of ICU patients16.

GOSSELINK et.al. (2011) developed a clinical management algorithm for physical activity and early mobilization of critical patients, aiming to facilitate the synthesis of knowledge and application of evidence supporting physical activity and early mobilization of adult patients in the intensive care unit. We selected 28 studies and were created from these 3 categories of patients: unconditioned, physiologically stable and unconscious or sedated. From these three categories the authors suggest the clinical management for each one17.

FINAL CONSIDERATIONS

Through this study it was intended to evaluate the hemodynamic variables of critical patients undergoing aerobic activity of the lower extremity (MMIIs), hospitalized in the ICU, and thereby infers the effectiveness and safety of this type of therapy. It was observed in this study that physical exercise present little or no effectiveness in the absorption of MMIIs edema. Moreover, there was a positive correlation between fluid balance and volumetry of lower extremities. The ankle measurement showed at figure 8, used for quantifying edema ranged depending on the water balance of the individuals studied.

The behavior of HR and FR characterized similarly to that intended by the literature for healthy individuals, increasing during exercise and returning slowly to the end of it. The SpO2 remained stable while on therapy which allows us to infer that this therapeutic modality of this study offered no risk of oxygen desaturation.

Regarding the variables of systolic and diastolic pressures, deviant behavior found in this study may be due to various physiological and pathophysiological mechanisms and require further investigations. It is noteworthy that the small number of patients studied is important information in this type of approach and the results we found should be analyzed as preliminary data. The future prospect of this study is to increase the number of samples observed for a better inference about the subject concerned.

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CRITICALLY ILL PATIENTS AND AEROBIC EXERCISE: ANALYSIS OF THE HEMODYNAMIC VARIABLES

ABSTRACT

The acquired immobility to critical patients in the intensive care units (ICU), reduces endurance and muscle strength, compromises the blood supply, develop generalized muscle weakness, resulting in poor quality of movement and makes it difficult weaning from mechanical ventilation. Exercise increases tone and contraction muscle as well as facilitating venous return, prevents and reduces the formation of edema. AIM: Evaluate the hemodynamic responses and lower limbs volumetric in

critically ill patients who underwent physical training in the ICU. METHODS: Qualitative research like case study, convenience sample by 02 critically ill patients in ICU.The physical training consisted of five sessions of aerobic exercise for lower limbs (MMIIs) at 20 minutes. The variables analyzed were: systolic and diastolic blood pressure (SBP and DBP, respectively), heart rate (HR), respiratory rate (RR), oxygen saturation (SpO2), water fluid balance and volume of MMIIs. RESULTS: The water fluid balance and the MMIIs volumetric showed a positive association, independent of edema formation. HR and RR were characterized as provided for in healthy subjects and SpO2 remained stable. SBP and DBP were characterized by divergent among patients, especially the DBP during the aerobic exercise. CONCLUSION: The physical training for patients in the ICU does not appear to significantly change from hemodynamic variables. The fragility of the number of sample in this study is an important aspect and despite to show himself as a safe therapeutic further investigation will be required about aerobic activity in critically l ll patients.

KEYWORDS: Intensive Care Units; Hemodynamics; Exercise

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PATIENTS GRAVEMENT MALADES ET EXERCICE PHYSIQUE: ANALYSE DE LA HÉMODYNAMIQUE VARIABLES

RÉSUMÉ

L'immobilité acquise critique pour pacientes dans les unités de soins intensifs (USI), la force musculaire et l'endurance Réduit, compromet l'approvisionnement en sang, de développer une faiblesse musculaire généralisée, ce qui entraîne la mauvaise qualité du mouvement et rend difficile le sevrage de la ventilation mécanique. L'exercice augmente le tonus musculaire et la contraction ainsi que faciliter le retour veineux, réduit et prévient la formation de l'œdème. BUT: Évaluer les réponses hémodynamiques et des membres inférieurs en pacientes volumétriques gravement malades qui ont subi un entraînement physique à l'USI. MÉTHODES: la recherche qualitative comme étude de cas, échantillon de commodité de 02 pacientes gravement malades à l'entraînement physique ICU.The se composait de cinq séances d'exercice aérobie pour les membres inférieurs (MMIIs) à 20 minutes. Les variables analysées étaient: pression artérielle systolique et diastolique (PAS et la PAD, respectivamente), fréquence cardiaque (FC), la fréquence respiratoire (RR), la saturation en oxygène (SpO2), la balance de l'eau et du volume de fluide de MMIIs. RÉSULTATS: L'équilibre de l'eau et les fluides volumétriques MMIIs montré une association positive, indépendante de la formation de l'œdème. RH et RR ont été caractérisées prévues dans les sujets en bonne santé et SpO2 est resté stable. PAS et la PAD ont été caractérisées par divergentes parmi pacientes, en particulier le BPD Au cours de l'exercice aérobie. Conclusion: L'entraînement physique est pacientes à l'USI ne semble pas modifier de manière significative à partir de variables hémodynamiques. La fragilité du nombre d'échantillon de cette étude est un aspect important et malgré de se montrer comme une enquête sécuritaire thérapeutique supplémentaire sera nécessaire critique sur l'activité aérobique je vais pacientes.

MOTS-CLÉS: unités de soins intensifs; Hémodynamique; Exercice

PACIENTES CRÍTICOS Y LA ACTIVIDAD AERÓBICA: UN ANÁLISIS DE VARIABLES HEMODINÁMICO

RESUMEN

La inmovilidad impuesta a los pacientes críticamente enfermos en las unidades de cuidados intensivos (UCI), reduce la resistencia y la fuerza muscular, compromete la irrigación sanguínea, desarrolla debilidad generalizada que resulta en la mala calidad de movimiento edema de las extremidades inferiores y el compromiso de la ventilación del destete. Como una alternativa de prevención y tratamiento de estas enfermedades neuromusculares terapia física se ha mantenido a través de programas de movilización precoz de los pacientes en estado crítico. OBJETIVO: Evaluar la respuesta de las variables hemodinámicas y volumetría de las extremidades inferiores (MMIIs) en pacientes críticos sometidos a entrenamiento físico en la ICU.METHODOLOGY: investigación cualitativa, tipo estudio de caso, que consiste en una muestra de conveniencia de 02 pacientes críticos en la UCI. El entrenamiento físico consistió en 5 sesiones de MMIIs ejercicio aeróbico durante 20 minutos. Las variables analizadas fueron: presión arterial (PA), frecuencia cardíaca (FC), frecuencia respiratoria (FR), la saturación de oxígeno (SpO2), el balance hídrico y la volumetría MMIIs. RESULTADOS: El balance hídrico y volumétrica MMIIs presentó una asociación positiva, independiente de la formación de edema en MMIIs, HR y RR caracteriza a que se refiere en personas sanas y SpO2 permanecieron estables. PAS y PAD fueron caracterizados de diferentes maneras entre los pacientes, especialmente a través del PAD ejercicio aeróbico. CONSIDERACIONES FINALES: El entrenamiento físico en pacientes de UCI no parece que los cambie significativamente de las variables hemodinámicas. La fragilidad de la muestra n en este estudio es un hecho importante e incluso demostrando ser una actividad terapéutica segura, una actividad aeróbica en pacientes críticos requiere mayor investigación.

PALABRAS CLAVE: Unidad de Cuidados Intensivos, Hemodinámica, Ejercicio

PACIENTES CRÍTICOS E ATIVIDADE AERÓBICA: UMA ANÁLISE DAS VARIÁVEIS HEMODINÂMICAS

RESUMO

O imobilismo imposto aos pacientes críticos, em unidades de terapia intensiva (UTI), reduz a resistência e força muscular, compromete a irrigação sanguínea, desenvolve fraqueza generalizada, resultando em má qualidade do movimento formação de edema de membros inferiores e comprometimento do desmame da ventilação. Como alternativa de prevenção e tratamento dessas doenças neuromusculares a fisioterapia tem sido defendida através de programas de mobilização precoce do paciente crítico. OBJETIVO: avaliar as respostas das variáveis hemodinâmicas e volumetria de membros inferiores (MMIIs) em pacientes críticos submetidos à treinamento físico dentro da UTI METODOLOGIA: Pesquisa qualitativa, do tipo estudo de casos, amostragem de conveniência composta por 02 pacientes críticos em UTI. O treinamento físico foi composto por 5 sessões de exercício aeróbico de MMIIs por 20 minutos. As variáveis analisadas foram: pressão arterial (PA), freqüência cardíaca (FC), freqüência respiratória (FR), saturação periférica de oxigênio (SpO2), balanço hídrico e volumetria de MMIIs. RESULTADOS: O balanço hídrico e a volumetria de MMIIs apresentaram associação positiva, independente da formação de edema nos MMIIs; FC e FR caracterizaram-se de forma prevista em sujeitos saudáveis e SpO2 manteve-se estável. PAS e PAD caracterizaram-se de forma divergente entre os pacientes, principalmente a PAD durante todo o exercício aeróbico. CONSIDERAÇÕES FINAIS O treinamento físico em pacientes de UTI parece não alterar de forma expressiva as variáveis hemodinâmicas. A fragilidade do n amostral neste estudo é um dado importante e mesmo mostrando-se como terapêutica segura á atividade aeróbica em pacientes críticos carece de maiores investigações.

PALAVRAS CHAVE: Unidades de Terapia Intensiva; Hemodinâmica; Exercício