Metabolic and Performance Differences of Cardiopulmonary Resuscitation Between a Hard Surface and Hospital Mattress

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Introduction

Cardiopulmonary Resuscitation is the most important procedure to preserve life following cardiac arrest. However, less than 15% of people survive. Without proper depth, the pressure of the circulated blood will be too low to maintain brain activity. [1-2] The AHA recommends a compression depth of 50-60 mm. [3] A study of compression depth with 1,029 analyzable cases found a strong association between survival outcomes and increased compression depth. For every 5 mm increase in depth, the return of spontaneous circulation increased by five people per 100 patients and the return of spontaneous circulation increased by 24 people per 100 patients. [4] A major contributor to the low survival statistic may be improper compressions during CPR related to the surface on which the patient is lying, requiring extra effort needed to reach proper depth. [1]

Methods

Participants

Thirty-four participants aged 19-27 years from the College of Nursing and Health Sciences participated in the research study.

Procedure

This study employed a randomized cross-over design using 2 -conditions (AHA BLS CPR on a hard surface and AHA BLS CPR on a hospital mattress) for a total of 24 minutes each session. Participants were instructed to wear a VO2 Master analyzer mask [5] while performing CPR (as defined by AHA guidelines for 2-rescuer CPR) on a QCPR Little Anne CPR mannequin during the testing sessions. [6]

Data Collection

Participants were assessed for Heart Rate average, VO2 difference (between min and max), Ve/VO2 difference, and FeO2 difference with the VO2 Master analyzer. [5] Average Depth (mm) and Average Rate (cpm) were recorded using the QCPR mannequin. [6] Additionally, participants were asked to rate their ratings of perceived exertion on a scale from 1 to 10 at the midpoint (12 min) and conclusion (24 min).

Results

Results indicated that CPR on a hospital mattress, instead of a hard surface, had detrimental impacts on provider effort, energy expenditure, and CPR performance. Results indicated that on a mattress instead of a hard surface:

- Heart rate average was 4bpm higher
- Oxygen consumption was 15L higher
- Expirations/Oxygen used was 3L higher
- Expiatory oxygen was 0.7L less
- CPR depth was 3.4 mm less
- RPE was 0.5 points higher at the midpoint and 0.2 overall
- Rate was not significantly different between conditions

	Mean	Sig. (2-tailed)
2-Min HR Avg - Mat HR Avg	-4.1 ± 9.8	.020
Hard VO2 Diff - Mat VOMat Diff	-14.8 ± 7.2	.000
Hard Ve/VO2 Diff - Mat Ve/VOMat Diff	-3.3 ± 8.3	.025
Hard FeO2 Diff - Mat FeOMat Diff	0.7 ± 1.3	.000
Hard Depth (mm) - Mat Depth (mm)	3.4 ± 3.5	.000
Hard RPE Mid - Mat RPE Mid	-0.5 ± 1.3	.006
Hard RPE End - Mat RPE End	-0.2 ± 1.0	.000

Discussion

We found that the energy expenditure and quality of compressions were all compromised when providers performed CPR on a hospital mattress instead of on a hard surface. Wallace et al. (2013) and Talikowska et al. (2015) found that the mean difference in chest compression depth between survivors and non-survivors was only 2 mm and 3 mm, with an average depth of 40 mm, respectively. [7-8] Performing CPR on a mattress had an average decrease of 3.4mm. Additionally, it required more energy and was noticeably more difficult to perform compressions. The added energy and effort of CPR on a mattress leads to reduced quality and endangers patients' lives.

References

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Acknowledgements

Funding was provided by West Texas A&M University and the Killgore Faculty Research program. The research was conducted at the Human Performance Research Lab at WTAMU