

FANSHAWE COLLEGE PARAMEDIC PROGRAMS

Paramedic – Evidence Based Medicine

Paramedic Critically Appraised Topic Worksheet



Title: Effects of increasing angle of patient positioning while performing CPR on perfusion.

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Clinical Scenario:

Paramedics respond to a middle-age patient who has experienced a medical cardiac arrest. The decision is made to extricate and the patient from the 30th floor of an apartment building, accessed only by an elevator not wide enough to allow the stretcher to be left in horizontal position. While it is possible to load the patient on the stretcher and fit in the elevator with head end titled on an upward angle, what effect will this positioning have on the patient’s perfusion pressure during CPR?

P-I-C-O (Population – Intervention – Comparison- Outcome) Question:

Does performing CPR increase the level of perfusion pressure when performed on cardiac arrest patients positioned at an incline angle as compared to a flat supine level?

Search Strategy:

[(MH “Resuscitation, Cardiopulmonary”) OR “cardiopulmonary resuscitation” OR (MH “Resuscitation”) OR “cpr”] AND [(MH “Perfusion”) OR “perfusion”] AND [“semi fowler” OR “fowler” OR “semi-fowler” OR “semi-fowlers” OR “position” OR (MH “Patient Positioning”) OR “head up” OR “reverse trendelenburg” OR “reverse trendelenberg” OR (MH “Head-Down Tilt”) OR (MH “Tilt”) OR “incline”] limited to 2012-2017. See Appendix A for search results table.

Search Outcome:

CINAHL Plus with Full Text database using EBSCOhost Research Databases interface results: 6

MEDLINE database using EBSCOhost Research Databases interface results: 9

Relevant Papers: The following papers were chosen to be relevant as they demonstrate strong levels of evidence based on the randomized control trial design.

Author, Date	Population: Sample Characteristics	Design (LOE)	Outcomes	Results	Strengths/ Weaknesses
Debaty et al. (2015)	n=22, pigs that were sedated, intubated, anaesthetized, paralyzed, induced VF (ventricular fibrillation). CPR performed using	RCT, LOE 1b.	CPP (coronary perfusion pressure). CerPP (cerebral perfusion pressure).	CPP increased from 19±2 mmHG at 0° to 30±3 at 30° HUT (head-up tilt) position. CerPP increased from 19±3 mmHg at 0° to 35±3 at 30° HUT.	<u>Strengths:</u> Design allowed study of multiple angles of HUT to identify optimal angle. Mechanical device kept CPR constant.

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	LUCAS and ITD (impedance threshold device).		Brain blood flow. Heart blood flow.	Brain blood flow increased from 0.19±0.04 ml/min/g at 0° to 0.27±0.04 ml/min/g at 30° HUT. No significant difference in heart blood flow.	<u>Weaknesses:</u> Small sample size. No human data collected. Interventions were applied in sequence as CPR was continued while changing table angle, may have confounded data. Conflict of interest statement acknowledges one researcher as the creator of a device used in study.
Kim et al. (2017)	n=12, pigs that were anaesthetized, intubated, paralyzed, and induced VF. CPR performed using LUCAS 2 and ITD.	RCT, LOE 1b.	CePP (cerebral perfusion pressure). CoPP (coronary perfusion pressure).	CePP values increased as angle of positioning increased from -60°, -45°, -30°, 0°, 30°, 45°, and 60°. Highest value for CePP was 39.4±0.6 mmHg at 45° and 39.9±0.3 mmHg at 60° HUT (similar values). CoPP did not follow same trend as CePP. Highest value for CoPP was 30.3±0.4 mmHg at 30° HUT.	<u>Strengths:</u> Design allowed study of multiple angles of HUT to identify optimal angle. Mechanical device kept CPR constant. <u>Weaknesses:</u> Small sample size. No human data collected. Interventions were applied to each group three times, may have confounded data. Conflict of interest statement acknowledges one researcher as the creator of a device used in study. All animals were successfully defibrillated and achieved ROSC regardless of the intervention group to which they belong making it difficult to make connections

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					between angle of tilt and overall survivability.
Ryu et al. (2016)	n=30, pigs that were sedated, intubated, anaesthetized, and induced VF. Automated device performed either C-CPR (conventional-CPR) or ACD (active compression decompression) device CPR and ITD depending on randomization.	RCT, LOE 1b.	CerPP. CPP.	<p>CerPP values were 6 ± 3 mmHG at 30° HUP (head up position) and -5 ± 3 mmHg at 0° SUP (supine position) after 22 minutes of C-CPR.</p> <p>CerPP values were 51 ± 8 mmHG at 30° HUP and 20 ± 5 mmHg at 0° SUP after 22 minutes of ACD CPR and ITD.</p> <p>CPP values appeared statistically insignificant.</p>	<p><u>Strengths:</u> Intervention administered for a more realistic time frame compared to similar papers.</p> <p>Mechanical device kept CPR constant.</p> <p>Animals belonged exclusively to each intervention group and were not re-entered into groups.</p> <p><u>Weaknesses:</u> Small sample size.</p> <p>Conflict of interest statement acknowledges one researcher as the creator of a device used in study.</p>

Comments:

A number of authors have contributed to all three papers which may explain the similarity in experimental design among the research done. Furthermore, the papers were all published in the same journal. Issues of small population size were not addressed in subsequent testing, and no human trials have been done. It is unknown how accurate this data would be if similar interventions were done on humans, especially considering the differences in anatomy and typical positioning. Pigs being four-legged animals are not adapted to living upright like humans and may show different patterns of blood flow and perfusion. It is also worth noting that the pigs selected were all relatively healthy subjects before trials where cardiac arrest is induced. This may be a source of significant difference when compared to patients who enter cardiac arrest due to sickness. Chest compressions are kept constant by an automated device in each experiment. While these devices may or may not be available to services responding to out of hospital cardiac arrests, it could be challenging to maintain proper form, force, and leverage if CPR was to be conducted manually on an angle. Head-up CPR may sometimes be done in the field out of necessity as in the case of a small elevator extrication. If tight space does not allow for the stretcher to be left in the horizontal position, modifications may be required to transport patients, even in the case of cardiac arrest.

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Consider: Why would you not change practice based on this article?

Multiple studies can be found to suggest that head-up CPR can show improved perfusion pressure over supine CPR in animal models, these studies include small numbers and are generally done by similar teams of researchers. More evidence is needed to translate these findings to human patients, and specifically in the field of paramedicine if out of hospital cardiac arrest protocols are to be changed.

Clinical Bottom Line:

These initial swine models show promising results to consider human trials. Currently the effectiveness of head-up CPR on humans, along with the practicality of the technique, is questionable.

References:

- Debaty, G., Shin, S., Metzger, A., Kim, T., Ryu, H. H., Rees, J., ... Lurie, K. (2015). Tilting for perfusion: head-up position during cardiopulmonary resuscitation improves brain flow in a porcine model of cardiac arrest. *Resuscitation*, *87*, 38-43. doi:10.1016/j.resuscitation.2014.11.019
- Kim, T., Shin, S. D., Song, K. J., Park, Y. J., Ryu, H. H., Debaty, G., ... Hong, K. J. (2017). The effect of resuscitation position on cerebral and coronary perfusion pressure during mechanical cardiopulmonary resuscitation in porcine cardiac arrest model. *Resuscitation*, *113*, 101-107. doi:10.1016/j.resuscitation.2017.02.008
- Ryu, H. H., Moore, J. C., Yannopoulos, D., Lick, M., McKnite, S., Shin, S. D., ... Lurie, K. G. (2016). The effect of head up cardiopulmonary resuscitation on cerebral and systemic hemodynamics. *Resuscitation*, *102*, 29-34. doi:10.1016/j.resuscitation.2016.01.033

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Appendix A:

EBSCOhost Research Databases search results.

#	Query	Limiters/Expanders	Last Run Via	Results
S20	S14 AND S15 AND S16	Limiters - Date of Publication: 20120101-20171231 Expanders - Apply related words Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Basic Search Database - MEDLINE	9
S19	S14 AND S15 AND S16	Expanders - Apply related words Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Basic Search Database - MEDLINE	29
S18	S14 AND S15 AND S16	Limiters - Published Date: 20120101-20171231 Expanders - Apply related words Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - CINAHL Plus with Full Text	6
S17	S14 AND S15 AND S16	Expanders - Apply related words Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - CINAHL Plus with Full Text	8
S16	S3 OR S4 OR S5 OR S6 OR S7 OR S8 OR S9 OR S10 OR S11 OR S12 OR S13	Expanders - Apply related words Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - CINAHL Plus with Full Text	44,297
S15	S1 OR S2	Expanders - Apply related words Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - CINAHL Plus with Full Text	17,832
S14	"perfusion"	Expanders - Apply related words Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - CINAHL Plus with Full Text	13,747
S13	(MH "Tilt") OR "incline"	Expanders - Apply related words Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - CINAHL Plus with Full Text	228
S12	(MH "Head-Down Tilt")	Expanders - Apply related words Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - CINAHL Plus with Full Text	82
S11	"reverse trendelenberg"	Expanders - Apply related words Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - CINAHL Plus with Full Text	5
S10	"reverse trendelenburg"	Expanders - Apply related words Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - CINAHL Plus with Full Text	29
S9	"head up"	Expanders - Apply related words Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - CINAHL Plus with Full Text	464
S8	"position" OR (MH "Patient Positioning")	Expanders - Apply related words Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - CINAHL Plus with Full Text	43,455
S7	"semi-fowlers"	Expanders - Apply related words Search modes - SmartText Searching	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - CINAHL Plus with Full Text	1

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S6	"semi-fowlers"	Expanders - Apply related words Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - CINAHL Plus with Full Text	0
S5	"semi-fowler"	Expanders - Apply related words Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - CINAHL Plus with Full Text	7
S4	"fowler"	Expanders - Apply related words Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - CINAHL Plus with Full Text	169
S3	"semi fowler"	Expanders - Apply related words Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - CINAHL Plus with Full Text	7
S2	"cpr"	Expanders - Apply related words Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - CINAHL Plus with Full Text	3,927
S1	(MH "Resuscitation, Cardiopulmonary") OR (MH "Resuscitation") OR "cardiopulmonary resuscitation"	Expanders - Apply related words Search modes - Find all my search terms	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - CINAHL Plus with Full Text	16,633