

Paramedic – Evidence Based Medicine (P-EBP) Program

Paramedic CAT (Critically Appraised Topic) Worksheet

Title: The effectiveness of mechanical CPR devices versus hands-on CPR in pre-hospital adult cardiac arrest

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2nd Party Appraiser: Jen Greene

Clinical Scenario: Two Paramedics are treating a middle-aged man for suspected acute coronary syndrome when suddenly the patient goes into cardiac arrest. One of the paramedics applies defibrillator pads on the patient while the other starts applying a mechanical CPR device to the patient. Will this patient benefit from a mechanical compression device compared to hands-on CPR and if they achieve Return of Spontaneous Circulation (ROSC) will it be accompanied with greater neurological outcomes?

PICO (Population – Intervention – Comparison – Outcome) Question:

(P) In the pre-hospital adult cardiac arrest patient, (I) does the use of mechanical compression device (C) compared to hands-on CPR (O) lead to an increase in return of spontaneous circulation and neurologically intact patients.

Search Strategy:

Search strategy for compression devices. We filtered for systematic review as we knew this was a mature research question with multiple RCTs so wondered whether it had been systematically reviewed and indeed it had.

#7 (16 search results)

Search: #1 AND #2 AND #5 Filters: Systematic Review
1611:32:19

#6 (322 search results)



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Search: #1 AND #2 AND #5
32211:31:00

#5 (32,166 search results)

Search: "compression device*" OR LUCAS OR autopulse OR "machine assisted" OR "MCPR" OR "mechanical CPR" OR "mechanical cardiopulmonary resuscitation" OR "mechanical compression" OR "pneumatic piston device*" OR "band compression device*" OR "band device*"
32,16611:29:13

#4 (no changes to search results)

Search: "compression device*" OR LUCAS OR autopulse OR "machine assisted" OR "MCPR" OR "mechanical CPR" OR "mechanical cardiopulmonary resuscitation" OR "mechanical comp*" OR "pneumatic piston device*" OR "band compression device*" OR "band device*"
011:27:58

#3 (no changes to search results)

Search: "compression device*" OR LUCAS OR autopulse OR "machine assisted" OR "MCPR" OR "mechanical CPR" OR "mechanical cardiopulmonary resuscitation" OR "mechanical comp*" OR "pneumatic piston device*" OR "band compression device*" OR "band device*" - Schema: all
011:27:58

#2 (48,372 search results)

Search: "out of hospital cardiac arrest" OR OOHCA OR OHCA OR "cardiac arrest" OR VSA OR "vital signs absent"
48,37211:23:11

#1 (201,610 search results)

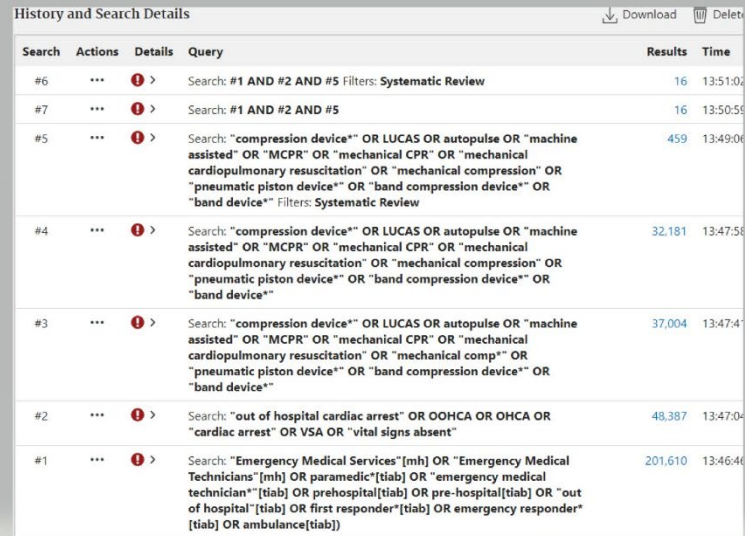
Search: "Emergency Medical Services"[mh] OR "Emergency Medical Technicians"[mh] OR paramedic*[tiab] OR "emergency medical technician*" [tiab] OR prehospital[tiab] OR pre-hospital[tiab] OR "out of hospital"[tiab] OR first responder*[tiab] OR emergency responder*[tiab] OR ambulance[tiab]
201,58211:19:37.










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Search Outcome:

After all the filters were applied, we narrowed the search results to 16.



Search	Actions	Details	Query	Results	Time
#6	...	 >	Search: #1 AND #2 AND #5 Filters: Systematic Review	16	13:51:00
#7	...	 >	Search: #1 AND #2 AND #5	16	13:50:59
#5	...	 >	Search: "compression device*" OR LUCAS OR autopulse OR "machine assisted" OR "MCPR" OR "mechanical CPR" OR "mechanical cardiopulmonary resuscitation" OR "mechanical compression" OR "pneumatic piston device*" OR "band compression device*" OR "band device*" Filters: Systematic Review	459	13:49:00
#4	...	 >	Search: "compression device*" OR LUCAS OR autopulse OR "machine assisted" OR "MCPR" OR "mechanical CPR" OR "mechanical cardiopulmonary resuscitation" OR "mechanical compression" OR "pneumatic piston device*" OR "band compression device*" OR "band device"	32,181	13:47:50
#3	...	 >	Search: "compression device*" OR LUCAS OR autopulse OR "machine assisted" OR "MCPR" OR "mechanical CPR" OR "mechanical cardiopulmonary resuscitation" OR "mechanical comp*" OR "pneumatic piston device*" OR "band compression device*" OR "band device"	37,004	13:47:40
#2	...	 >	Search: "out of hospital cardiac arrest" OR OOHCA OR OHCA OR "cardiac arrest" OR VSA OR "vital signs absent"	48,387	13:47:00
#1	...	 >	Search: "Emergency Medical Services"[mh] OR "Emergency Medical Technicians"[mh] OR paramedic[tiab] OR "emergency medical technician"[tiab] OR prehospital[tiab] OR pre-hospital[tiab] OR "out of hospital"[tiab] OR first responder[tiab] OR emergency responder[tiab] OR ambulance[tiab]	201,610	13:46:40



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AUTHOR, DATE	POPULATION: SAMPLE CHARACTERISTICS	DESIGN (LOE)	OUTCOMES	RESULTS	STRENGTHS/ WEAKNESSES
Wang PL, Brooks SC. 2018	12,944 adult patients who suffered either out-of-hospital cardiac arrest or in-hospital cardiac arrest.	<ul style="list-style-type: none"> - RCT's - Cluster RCT's - Quasi-randomised studies <p style="text-align: center;">Level I Evidence</p>	<ul style="list-style-type: none"> - Survival rate - Neurological function 	<p>Various papers showed benefit with mechanical chest compressions compared with manual compressions: 14.3% versus 0% 55.3% versus 37.8 44.9% versus 23.4%</p> <p>Several papers showed either harm nor benefit 31.6% versus 31.4% 35.4% versus 34.6% 40.5% versus 31.9%</p> <p>One large study favored hands-on over mechanical: 5.3% versus 4.1%</p>	<p>Strengths</p> <ul style="list-style-type: none"> - Cochran study - Systemic Review <p>Weaknesses</p> <ul style="list-style-type: none"> - Some high risk of bias in some studies - In hospital cardiac arrests
Sheraton, Columbus, Surani, Chopra, Kashyap, 2021	18,474 adult patients in non-traumatic cardiac arrests that reported ROSCs.	<ul style="list-style-type: none"> - RCT's - Observational studies - Published between Jan 2000 and Oct 2020 - Systematic Review with meta-analysis <p style="text-align: center;">Level I Evidence</p>	<ul style="list-style-type: none"> - Compare effectiveness of Lucas and Auto pulse vs. manual compressions - Achieving ROSC 	<p>Mechanical chest compressions did not significantly improve ROSC (relative risk (RR) 0.80, 95% confidence interval (CI), 0.61, 1.04, P = 0.10; when compared with manual chest compressions in patients undergoing resuscitation after OHCA (M-H odds ratio (OR) = 1.16, 95% CI, 0.97, 1.39, P = 0.11).</p>	<p>Strengths</p> <ul style="list-style-type: none"> - Systemic Review - Out of hospital studies <p>Weaknesses</p> <ul style="list-style-type: none"> - Only studied Lucas and Auto pulse - Only English studies



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Relevant Papers:

- Mechanical vs. manual chest compressions on cardiac arrests (2018)
 - o Cochran Library
 - o PMID : 30125048
- Effectiveness of mechanical chest compression devices over manual cardiopulmonary resuscitation: a systemic review with meta-analysis and trial sequential analysis (2021)
 - o PMID : 35353993

Comments: Although both studies net a neutral result as to whether mechanical CPR is superior to hands only CPR in terms of ROSC rate, some studies have shown that mechanical compressions are sometimes superior to hands-on compressions. However, with mechanical compressions there is a higher prevalence of trauma in our out of hospital (OHCA) patients.

Consider:

Due to the lack of proof that there is any benefit to the cardiac arrest patients by using a mechanical device, we wouldn't change current practice of doing hands on CPR. It would be beneficial to further research this question, but on a clinician physical health and wellness aspect to using a mechanical device.

Clinical Bottom Line:

All the trials analyzed showed that there was no clear evidence that a mechanical device would increase the chance for a ROSC or increase neurological function for those patients that did survive.

References: Sheraton, M., Columbus, J., Surani, S., Chopra, R., & Kashyap, R. (2021). Effectiveness of Mechanical Chest Compression Devices over Manual Cardiopulmonary Resuscitation: A Systematic Review with Meta-analysis and Trial Sequential Analysis. *Western Journal of Emergency Medicine*. Volume 22, no. 4. DOI: 10.5811/westjem.2021.3.50932

