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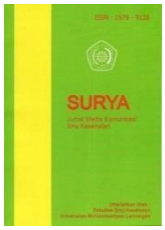

Resusitasi Jantung Paru (RJP) Mekanik Lebih Baik Dari RJP Manual? Studi Literatur

(Mechanical Cardiopulmonary Resuscitation (CPR) Is Better Than Manual CPR? Literature Study)

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ABSTRAK

Pendahuluan: CPR mekanik mengurangi kelelahan penolong dan memastikan kesesuaian dengan pedoman, sehingga berpotensi meningkatkan angka keselamatan secara keseluruhan. Sebaliknya, CPR manual bergantung pada keterampilan penolong, sehingga menimbulkan tantangan dalam menjaga performa dan daya tahan. Mengungkap kompleksitas dalam permasalahan ini menjadi penting dalam membentuk paradigma resusitasi di masa depan. Tujuan penelitian ini adalah untuk mengetahui efektivitas CPR mekanik dalam penatalaksanaan henti jantung dibandingkan dengan CPR manual

Metode: Database yang digunakan adalah Pubmed dan Proquest dengan menggunakan kata kunci "Mechanical CPR", "Automatic CPR Device" dan "Cardiac Arrest". Kriteria inklusi diterbitkan dalam 5 tahun terakhir, menganalisis pengaruh alat CPR otomatis pada manajemen henti jantung, serta artikel teks lengkap berbahasa inggris. Kriteria eklusinya adalah tinjauan literatur, tinjauan sistematik atau bukan penelitian asli. Jumlah artikel yang layak direview adalah 10 artikel jurnal

Hasil: Penggunaan alat CPR otomatis masih kalah dibandingkan dengan CPR manual pada henti jantung dengan nilai kegunaan 4-5% dari seluruh pasien serangan jantung. Terdapat 4 jurnal yang menyatakan bahwa HJLRS dalam penatalaksanaan henti jantung menggunakan alat CPR otomatis lebih tinggi dibandingkan manual, namun terdapat 2 artikel jurnal yang melaporkan sebaliknya. Alat CPR otomatis sangat rentan terhadap cedera dengan patah tulang mencapai 85,5% dari total cedera dibandingkan dengan CPR manual yang tidak mengalami cedera.

Kesimpulan: Penggunaan alat CPR otomatis tidak memberikan hasil yang lebih baik dibandingkan CPR manual terhadap ROSC secara keseluruhan, namun sangat berguna dan bermakna pada kondisi tertentu seperti saat proses transportasi, oleh karena itu alat CPR otomatis lebih bermakna untuk penggunaan pra rumah sakit.

Kata Kunci: CPR, Manual CPR, Mechanical CPR, OHCA

ABSTRACT

Introduction: Mechanical CPR mitigate rescuer fatigue and ensure adherence to guidelines, potentially enhancing overall survival rates. Contrarily, manual CPR relies on human skill, presenting challenges in maintaining uniformity and endurance. Unveiling the complexities within this juxtaposition becomes imperative in shaping future resuscitative paradigms. The purposeof studi is to determine the effectiveness of mechanical CPR in cardiac arrest management compared to manual CPR
Methods: Database used were Pubmed and Proquest using the keywords "Mechanical CPR", "Automatic CPR Device" and "Cardiac Arrest". The inclusion criteria were last 5 years published, analyzing the effect of automatic CPR devices on cardiac arrest management, as well as full text articles in english. The exclusion criteria are literature review, systematic review or is not original research. The number of articles eligible for review is 10 journal articles
Results: The use of automatic CPR equipment is still inferior compared to manual CPR during cardiac arrest with the use value being 4-5% of all cardiac arrest patients. There are 4 journals that state that ROSC in cardiac arrest management using automatic CPR devices is higher than manual, but there are 2 journal articles that report the opposite. Automatic CPR device is very vulnerable to injury with fractures reaching 85.5% of total injuries compared to manual CPR which does not experience injury.
Conclusion: The use of automatic CPR device does not produce better results than manual CPR overall for ROSC, but is very useful and meaningful in certain conditions such as during the transportation process, therefore, the automatic CPR device is more meaningful for pre-hospital use

Keywords: CPR, Manual CPR, Mechanical CPR, OHCA

PENDAHULUAN

Angka keselamatan pasien henti jantung adalah 8% dan merupakan penyebab terbesar jutaan kematian dini di dunia (Chen et al. 2017; Lu et al. 2016). Henti Jantung Luar Rumah Sakit (HJLRS) merupakan masalah besar dengan kejadian global sekitar 14-147 per 100.000 orang per tahun. (Liou et al. 2021; Murphy et al. 2022). Lebih dari 356.000 HJLRS terjadi di Amerika Serikat setiap tahunnya (American Heart Association 2021). 80% korban HJLRS meninggal sebelum mendapat pertolongan dari petugas kesehatan (Lu et al. 2016).

Angka kematian HJLRS di Korea Selatan sebesar 97,7% sedangkan di Tiongkok di atas 90%.(Chen et al. 2017; Jin et al. 2013). Tingginya angka kematian HJLRS ini disebabkan karena korban tidak segera mendapatkan tindakan yang tepat pada saat kejadian, salah satunya karena tidak adanya saksi, tidak adanya saksi yang dapat menolong, dan fasilitas kesehatan yang jauh. Peluang keselamatan korban HJLRS menurun 7-10% setiap menitnya jika tidak diberikan intervensi (Chen et al. 2017).

Angka kejadian henti jantung belum tercatat secara optimal di Indonesia. Namun angka kejadian henti jantung dapat meningkat

seiring dengan meningkatnya angka kejadian Penyakit Jantung Koroner (PJK). Diperkirakan 10.000 orang per tahun atau sekitar 30 orang mengalami serangan jantung setiap harinya di Indonesia (Yunus and Damanasyah 2017).

Kelangsungan hidup pasien HJLRS dipengaruhi oleh beberapa faktor, antara lain Resusitasi Jantung Paru (RJP), akses AED, dan layanan medis darurat (EMS) yang terorganisir dengan baik (Yang et al. 2022). Kualitas RJP menjadi salah satu faktor penentu utama kehidupan korban henti jantung (Cha et al. 2019; Ng et al. 2021; Sudiro 2020). Menurut Poole, et al (2018) RJP merupakan faktor kunci dalam kelangsungan hidup pasien henti jantung (Poole et al. 2018).

Pelaksanaan RJP tidak mempunyai jaminan waktu, tidak ada jaminan dengan 5 siklus RJP pasien henti jantung akan kembali ke Return of Spontaneous Circulation (ROSC) atau Sirkulasi Spontan. Jadi pemberian RJP yang berkualitas harus benar-benar konsisten. Kualitas RJP ditunjukkan dengan frekuensi kompresi dada 100-120x/menit, kedalaman 5-6 cm, waktu jeda minimal dan recoil sempurna pada setiap kompresi. (Panchal et al. 2020).

RJP yang berkualitas akan sangat sulit dilakukan ketika pasien berada di dalam ambulan yang bergerak atau pada saat transportasi dan evakuasi seperti di atas tandu. (Halperin and Carver 2010; Jörgens et al. 2021; Yang et al. 2022). Melakukan RJP pada area yang tidak rata dan lunak juga mempengaruhi kualitas CPR, karena sulit mencapai kedalaman minimal 5 cm. (Poole et al. 2018).

Alat RJP otomatis dapat menjadi alat alternatif untuk menjaga kualitas RJP yang baik dengan menghindari kelelahan penolong, terutama pada situasi resusitasi yang buruk. (Cha et al. 2019; Poole et al. 2018). Halperin dan Carver (2010) juga mengatakan bahwa alat CPR otomatis dapat memberikan kompresi dada berkualitas tinggi pada ambulan yang bergerak, hal ini sangat sulit dilakukan dengan RJP manual. (Halperin and Carver 2010).

Penelitian sebelumnya memperoleh hasil yang berbeda, Spiro, et al (2015) menyatakan bahwa hasil RJP mekanik lebih baik dibandingkan dengan RJP manual, dengan tingkat kelangsungan hidup pasien yang menggunakan RJP manual sebesar 11% sedangkan yang menggunakan alat RJP Otomatis sebesar 28% (Spiro et al. 2015). Hasil penelitian Zeiner, et al (2015) menunjukkan bahwa penggunaan alat RJP mekanik mempunyai hasil yang lebih buruk berdasarkan pengukuran kategori kinerja otak (CPC) dibandingkan kelompok yang mendapat RJP manual yaitu 58,8% dibandingkan 78,6% pada pasien dengan RJP mekanik. panduan RJP (Zeiner et al. 2015). Hasil lainnya, Sudiro (2020) mengatakan tidak terdapat perbedaan angka kelangsungan hidup pada intervensi RJP otomatis dan RJP manual. (Sudiro 2020).

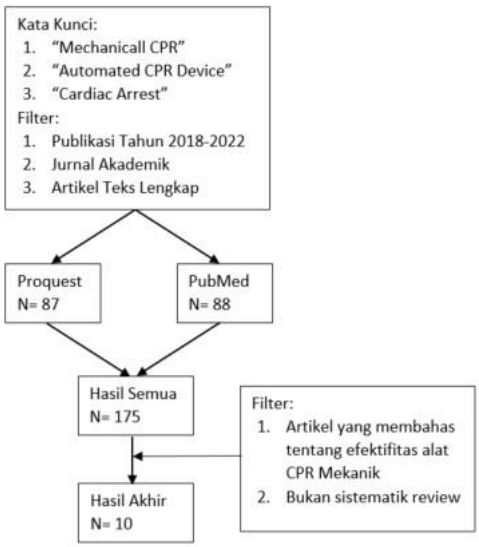
Berdasarkan penjelasan diatas maka sangat perlu dilakukan studi literatur mengenai pelaksanaan RJP dengan menggunakan alat mekanik dan RJP manual. Hasil yang berbeda dimungkinkan karena adanya bias pada setiap penelitian. Dalam setiap penelitian, penggunaan metode, pengambilan sampel dan pelaksanaan penelitian memungkinkan diperolehnya kesimpulan yang berbeda-beda. Setiap penelitian mungkin mempunyai kekurangan tersendiri yang harus dievaluasi

METODE PENELITIAN

Metode yang digunakan dalam penelitian ini adalah studi literatur. Data yang digunakan dalam penelitian ini adalah data sekunder artikel jurnal melalui pencarian artikel menggunakan database Pubmed dan Proquest. artikel jurnal yang direview dalam penelitian dengan menggunakan kata kunci "Mechanical CPR", "Automatic CPR Device" and "Cardiac Arrest".

Artikel yang direview dalam penelitian ini harus memenuhi kriteria inklusi yaitu artikel terbitan 2018-2022 dalam bahasa Inggris, analisis pengaruh alat RJP otomatis terhadap penatalaksanaan henti jantung, serta artikel full

text. sedangkan kriteria eksklusinya adalah artikel berbentuk tinjauan pustaka atau bukan penelitian orisinal .



Gambar 1. Diagram pencarian artikel

HASIL PENELITIAN

Hasil pencarian artikel dapat dilihat pada tabel 1 (Lampiran). Berdasarkan hasil pencarian artikel, tabel 2 dibawah ini merupakan karakteristik artikel.

Tabel 2. Karakteristik Artikel

Metode		n	%
Kriteria Artikel	Artikel Teks Lengkap	10	100
Tehnik Sampling	Studi Retrospektif	10	100
Instrumen	Alat RJP Otomatis Merk LUCAS	2	20
	Alat RJP Otomatis Merk LUCAS dan Autopulse	1	10
	Alat RJP Otomatis tanpa menyebutkan merk	7	70
Variabel	ROSC	7	70
	Neurologic	1	10
	Trauma	1	10
	Transport ke Rumah Sakit	1	10
Analisis Statistik	t-Test	2	20
	Logistic Regresion	1	10
	Chi Square	6	60
	Mann-Whitney	1	10

Pada Tabel 2 terlihat karakteristik 10 artikel yang jenis alat yang digunakan adalah alat CPR otomatis, 7 artikel tidak menyebutkan merek dan 3 artikel menyebutkan merek LUCAS. Sedangkan analisis statistik yang banyak digunakan adalah Chi-Square dan Paired T-test (60%).

PEMBAHASAN

a. Penggunaan Alat CPR Otomatis

Penggunaan alat CPR otomatis dapat memberikan kompresi (kecepatan dan kedalaman) yang lebih konsisten dibandingkan kompresi manual. Namun AHA tidak merekomendasikan penggunaan alat CPR otomatis karena tidak ada bukti bahwa alat otomatis memberikan hasil yang lebih baik dibandingkan kompresi manual.

Menghilangkan kelelahan penolong, kompresi dada yang konsisten dan handal merupakan keunggulan utama alat RJP otomatis. Namun, masih ada beberapa bukti bahaya dan kurangnya manfaat klinis dari RJP mekanik, yaitu pneumotoraks, patah tulang rusuk, dan cedera viseral. (Kim et al. 2019).

Meskipun penggunaan alat RJP otomatis dapat meningkatkan hasil ROSC, namun tidak dapat digunakan pada kasus tertentu, seperti saat pasien mengalami kelainan anatomi akibat cedera dada. (Seewald et al. 2019).

Pada penelitian ini tidak semua artikel menyebutkan bahwa alat RJP Otomatis menghasilkan ROSC yang lebih baik dibandingkan dengan RJP manual. Oleh karena itu, manfaat dari Alat RJP Otomatis mungkin bukan pada manfaat kelangsungan hidup pasien tetapi memungkinkan tim untuk memusatkan perhatian mereka pada aspek resusitasi lainnya, seperti manajemen jalan napas, akses vaskular, dan mengatasi penyebab henti napas yang dapat dibalik, terutama pada sistem dengan keterbatasan. personil (Mastenbrook et al. 2022).

b. ROSC / Kembalinya Sirkulasi Spontan

Dari paragraf sebelumnya dapat disimpulkan bahwa manfaat penggunaan alat

RJP otomatis tidak lebih unggul dibandingkan RJP manual. Ada beberapa kondisi yang membuat alat RJP otomatis lebih berguna, seperti saat transportasi dan saat RJP berlangsung lama.

3 (tiga) artikel jurnal yang hasilnya lebih mengunggulkan alat RJP otomatis menyatakan bahwa alat RJP otomatis lebih efektif dibandingkan RJP manual dalam mencapai ROSC, terutama pada pasien dengan serangan jantung yang disaksikan, ritme non-shockable, dan waktu respons EMS yang singkat. Temuan ini mendukung pentingnya aktivasi EMS dini dan RJP dini berkualitas tinggi pada tahap pra-rumah sakit (Chen et al. 2021; Crowley et al. 2020; Seewald et al. 2019).

Sedangkan 2 artikel jurnal menyebutkan bahwa penggunaan alat RJP otomatis memberikan hasil yang lebih buruk pada ROSC dan menggunakan RJP manual lebih baik. Penggunaan perangkat RJP mekanik di tempat kejadian tidak praktis dan sering kali menyebabkan gangguan kompresi dada selama 20 hingga 30 detik (atau lebih lama).

Faktanya, penggunaan CPR mekanik dikaitkan dengan tingkat kelangsungan hidup yang lebih rendah setelah keluar dari rumah sakit, ROSC, dan ukuran hasil antara lainnya. Temuan ini konsisten di seluruh analisis (Gonzales et al. 2019; Newberry et al. 2018).

c. Cedera dalam Penatalaksanaan Henti Jantung dengan Alat RJP Otomatis

Angka kematian setelah 30 hari jauh lebih tinggi pada pasien yang dibantu menggunakan alat RJP otomatis (Karasek et al. 2021). Peningkatan angka trauma sering dikaitkan dengan kompresi dada dengan alat RJP mekanik dibandingkan manual. Trauma dapat mengancam nyawa dan/atau dapat menyebabkan cedera bila dikombinasikan dengan intervensi medis seperti terapi antitrombotik dan antikoagulan, yang dapat menyebabkan cedera fatal pada korban. (Karasek et al. 2021).

Cedera yang paling sering terjadi adalah patah tulang dengan 478 (85,5%) pada kelompok manual dibandingkan 56 (87,5%) pada kelompok mekanik (Karasek et al. 2021).

KESIMPULAN

Penggunaan alat RJP otomatis tidak memberikan hasil yang lebih baik dibandingkan RJP manual secara keseluruhan untuk ROSC, namun penggunaan alat RJP otomatis sangat berguna dan bermakna pada kondisi tertentu seperti saat proses transportasi, oleh karena itu penggunaan alat CPR otomatis lebih bermakna. untuk penggunaan pra-rumah sakit. Penggunaan peralatan CPR otomatis memiliki risiko cedera yang sangat tinggi, dengan patah tulang menempati urutan teratas.

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Tabel 1. Hasil Pencarian Artikel

No	Penulis, Tahun	Judul	Methode (Desain, Sampel, Variabel, Instrumen, Analisis)	Hasil	Database
1	Li Luo, Xiao Dong Zhang, Tao Xiang, Hang Dai, Ji Mei Zhang, Guang Ying Zhuo, Yu Fang Sun, Xiao Jun Deng, Wei Zhang and Ming Du, 2021	Early Mechanical Cardiopulmonary resuscitation can improve outcomes in patients with non traumatic cardiac arrest in the emergency department	D: Retrospective Observational Study S: 68 Cardiac Arrest Patients from May 2018 – December 2019 V: ROSC I: Lucas Automatic CPR Device A: Data are presented with the standard deviation of the mean and compared using the t test. Categorical data were presented as percentages or levels and compared with the v2 test. SPSS software (version 15.0; SPSS Inc., Chicago, IL, USA) was used for analysis. P<0.05 indicates statistical significance.	The ROSC rate was higher in group 1 vs group 2 (69.2% vs 52.4%, respectively). The 4-hour survival rate was significantly higher in the early vs late group (83.3% vs 45.5%, respectively), and the duration of CPR was significantly shorter in the early group.	Proquest
2	Stephan Seewald, Manuel Obermaier, Rolf Lefering, Andreas Bohn, Michael Georgieff, Claus-Martin Muth, Jan-Thorsten Gra¨sner, Siobha´n Masterson, Jens Scholz, Jan Wnent, 2019	Application of mechanical Cardiopulmonary resuscitation devices and their value in out-ofhospital cardiac arrest: A retrospective analysis of the German Resuscitation Registry	S: 19,609 Cardiac Arrest Patients from 2007-2014 V: ROSC I: Lucas and Autopulse Automatic CPR Devices A: Multivariate logistic regression analysis, odds ratio for ROSC was 1.27 (95%-CI 1.09-1.48) with mechanical vs manual CPR. After adjusting for CPR duration, the model showed a significant benefit for mechanical CPR over manual CPR (OR 1.77 (95%-CI1.48-2.12) for mechanical CPR).	ROSC was achieved in 51.5% of the mechanical CPR group (95%-CI 48.2–54.8%, expected ROSC 42.5%) and in 41.2% in the manual CPR group (95%-CI 40.4–41.9%, expected ROSC 39.2%). After multivariate adjustment, mechanical CPR was found to be an independent predictor of ROSC (OR 1.77; 95%-CI 1.48-2.12). The duration of CPR is the main determinant of achieving ROSC.	Proquest
3	Joshua Mastenbrook, Kathryn E. Redinger, Duncan Vos, Cheryl Dickson, 2022	Retrospective Comparison of Prehospital Sustained Return of Spontaneous Circulation (ROSC) Rates Within a Single Basic Life Support Jurisdiction Using Manual vs Lund University Cardiac Assist System (LUCAS-2) Mechanical Cardiopulmonary Resuscitation	D: Retrospective Analysis Study S: 264 Cardiac Arrest Patients from July 2011 – October 2017 V: ROSC I: Lucas Automatic CPR Device A: Chi-square analysis was used to assess the impact of the introduction of the LUCAS-2 device by comparing the incidence of ROSC achieved in OHCA using manual chest compressions. Logistic regression models were used to assess the association of independent variables with prehospital ROSC	ROSC rates were 29.7% (22/74) and 29.5% (56/190), respectively, for manual CPR alone and LUCAS-assisted CPR (p=0.9673). Logistic regression revealed a significant association between ROSC and two independent variables: presence of witness (OR 3.104; 95% CI 1.896-5.081; p<0.0001) and shockable rhythm (OR 2.785; 95% CI 1.492-5.199; p<0, 0013).	Proquest

			achievement		
4	Peter A. Kahn, Sanket S. Dhruva, Taeho Greg Rhee, Joseph S. Ross., 2019	Use of Mechanical Cardiopulmonary Resuscitation Devices for Out-of-Hospital Cardiac Arrest, 2010-2016	D: Retrospective Cross-sectional Study S: 892,022 Cardiac Arrest Patients from 2010 – 2016 V: Discharge to Hospital I: Automatic CPR Tool A: We use descriptive statistics to characterize the patient sample. Chi Square Tests were used to compare demographic and geographic characteristics. Logistic regression analysis multivariable corrected for nonindependent observations within EMS agencies	we found that 87.6% of patients who received manual CPR were transferred by EMS to a hospital for further treatment and 0.4% died before transfer, whereas 91.3% of patients who received mechanical CPR were transferred by EMS to a hospital for further treatment. advanced and 0.3% died before transfer; among patients receiving mechanical CPR, the proportion taken to hospital increased statistically, but only slightly, from 0.5% in 2010 to 91.8% in 2016.	PubMed
5	Yi-Rong Chen, Chi-Jiang Liao, Han-Chun Huang, Cheng-Han Tsai, Yao-Sing Su, Chung-Hsien Liu, Chi-Feng Hsu, and Ming-Jen Tsai, 2021	The Effect of Implementing Mechanical Cardiopulmonary Resuscitation Devices on Out-of-Hospital Cardiac Arrest Patients in an Urban City of Taiwan	D: Cohort Retrospective S: 552 Out-of-Hospital Cardiac Arrest Patients V: ROSC I: Automatic CPR Tool A: Data of included OHCA patients were described and compared between the two groups, with and without the use of mechanical CPR. For continuous variables, Student's t-test or Mann-Whitney U test was used, according to data distribution. For categorical variables, the chi-square test was used. To evaluate the net effect of mechanical CPR on patient outcomes, forward stepwise logistic regression analysis was performed, with adjustment for variables with a p value <0.1	Of 552 patients with OHCA, 279 received mechanical CPR and 273 receive manual CPR, before going to the hospital. Mechanical CPR was independently associated with achieving ROSC (OR = 1.871; 95%CI: 1.195–2.930) and sustained (24 hours) ROSC (OR = 2.353; 95%CI: 1.427–3.879). Subgroup analysis showed that mechanical CPR was beneficial in shorter emergency medical services response times (<4 minutes), cardiac arrest witnesses, and nonshockable heart rhythms.	PubMed
6	Hyun Tae Kim, Jae Guk Kim, Yong Soo Jang, Gu Hyun Kang, Wonhee Kim, Hyun Young Choi, Gwang Soo Jun, 2019	Comparison of in-hospital use of mechanical chest compression devices for out-of-hospital cardiac arrest patients	D: Observational Retrospective S: 820 Out-of-Hospital Cardiac Arrest Patients V: ROSC I: Autopulse and LUCAS Automatic CPR Tools A: Univariate analysis, Mann-Whitney U test was used to compare continuous variables and chisquare or Fisher exact test for categorical variables. To identify predictors of outcome, the effects of statistically significant	LUCAS demonstrated inferior survival than AUTOPULSE (OR, 0.23; 95% CI, 0.06-0.84), although it did not show a significant association with ROSC. Percutaneous coronary intervention (OR, 6.30; 95% CI, 1.53-25.95) and target temperature management (TTM; OR, 7.30; 95% CI, 2.27-23.49) were independent factors to survive. In the	PubMed

			covariates after PSM were evaluated with adjusted odds ratios from multivariate logistic regression. P value < 0.05.	witnessed subgroup, female (OR, 0.46; 95% CI, 0.24-0.89) was a prognostic factor for ROSC and shockable rhythm (OR, 5.04; 95% CI, 1.00-25.30), percutaneous coronary intervention (OR, 12.42; 95% CI, 2.04-75.53), and TTM (OR, 9.03; 95% CI, 1.86-43.78) for survival. In the unknown subgroup, no prognostic factors were found for ROSC, and TTM (OR, 99.00; 95% CI, 8.9-110.62) was found to be an independent factor for survival.	
7	J. Karaseka, A. Blankovab, A. Doubkovác, T.Pitasovac, D. Nahalkac, T. Bartesc, J. Hladikd, T. Adamekb, T. Jirasekb, R. Polaseka, P. Ostadale, 2021	The comparison of cardiopulmonary resuscitation-related trauma: Mechanical versus manual chest compressions	D: Retrospective Analysis Study S: 820 Out-of-Hospital Cardiac Arrest Patients V: Trauma After Mechanical CPR I: Automatic CPR Tool A: Continuous variables were compared using no t-test pair two Student choices. Differences with $p<0.05$ were considered statistically significant. Logistic regression was used to identify variables independently associated with trauma.	Manual CPR was performed on 559 patients and mechanical on 64 subjects. No differences were found in the incidence of CPR-related injuries between groups. Our results showed that mechanical chest compressions did not increase the incidence and severity of CPR-related injuries compared with manual methods despite the significantly longer duration of CPR.	PubMed
8	Ryan Newberry, Ted Redman, Elliot Ross, Rachel Ely, Clayton Saidler, Allyson Arana, David Wampler, David Miramontes, 2018	No Benefit In Neurologic Outcomes Of Survivors Of Out-Of-Hospital Cardiac Arrest With Mechanical Compression Device	D: Retrospective Analysis Study S: 820 Out-of-Hospital Cardiac Arrest Patients V: Neurological Results After Mechanical CPR I: Automatic CPR Tool A: Descriptive statistics were produced, and chi-square tests and t-tests were performed to determine differences between the mechanical and standard CPR groups. Multivariate logistic regression models were used to adjust for the effects of possible confounders and Utstein variables on survival outcomes. Statistical significance was defined as $p < 0.05$ and 95% confidence intervals were obtained when appropriate	2,236 received manual CPR and 763 used mechanical CPR devices during resuscitation. ROSC was achieved in 44% (334/763) of mechanical CPR resuscitations and in 46% (1,020/2,236) of standard manual CPR resuscitations ($p= 0.32$). Survival to hospital discharge was observed in 7% (52/763) of the mechanical CPR resuscitation and 9% (191/2,236) of the manual CPR group ($p = 0.13$). Discharge with a CPC score of 1 or 2 was observed in 4% (29/763) of the mechanical CPR resuscitation group and 6% (129/2,236) of the	PubMed

				manual CPR group (p = 0.036).	
9	Louis Gonzalesa, Brandon K. Oylerb, Jeff L. Hayesa, Mark E. Escotta, Jose G. Cabanasc, Paul R. Hincheyc, Lawrence H. Brown, 2019	Out-of-Hospital Cardiac Arrest Outcomes with "Pit Crew" Resuscitation and Scripted Initiation of Mechanical CPR	D: Retrospective Analysis Study S: 444 out-of-hospital cardiac arrest patients V: ROSC I: Automatic CPR Device A: Chi-square and Wilcoxon rank sum tests, as appropriate, were used to compare characteristics across mechanical and manual CPR cohorts. Multivariable logistic regression combines variables known to be associated with cardiac arrest outcomes	Of the 444 eligible OHCAs, 217 received manual and 227 received mechanical CPR. Crude ROSC (39.2% vs 29.1%) and survival to discharge (13.8% vs 5.7%) were higher with manual CPR. In propensity-matched analysis (n = 176 manual CPR; 176 mechanical CPR), both ROSC (38.6% vs. 28.4%; difference: 0.2%; CI: 0.4% to 20.0%) and Survival to discharge (13.6% vs. 6.8%; difference: 6.8%; CI: 0.5% to 13.3%) remained significantly higher for patients who received manual CPR	PubMed
10	Conor P. Crowley, Emily S. Wan, Justin D. Salciccioli, Edy Kim, 2020	The Use of Mechanical Cardiopulmonary Resuscitation May Be Associated With Improved Outcomes Over Manual Cardiopulmonary Resuscitation During Inhospital Cardiac Arrests	D: Retrospective Analysis Study S: 104 Cardiac Arrest Patients V: ROSC I: Automatic CPR Device A: Chi-square/Fisher's test was performed for univariate data to determine the relationship between CPR method, ROSC, and survival. Multivariable logistic regression models were created to assess the possibility of potential confounding variables	59 patients received mechanical CPR and 45 manual. ROSC was 83% in mechanical CPR versus 48.8% in the manual group (p = 0.009). The survival-to-discharge rate was 32.2% for mechanical CPR versus 11.1% for manual (p = 0.02). Of the patients who survived to discharge and received mechanical CPR, 100% (n = 19) had a good neurologic outcome versus 40% (two of five) of patients who survived and received manual cardiopulmonary resuscitation (p = 0.005).	PubMed