INPLASY

Does Autopulse Mechanical Chest Compression Improve Outcomes After Cardiac Arrest? A systemic review and meta-analysis

INPLASY202410002
doi: 10.37766/inplasy2024.1.0002
Received: 02 January 2024
Published: 02 January 2024

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ADMINISTRATIVE INFORMATION

Support - No.

Review Stage at time of this submission - Completed but not published.

Conflicts of interest - None declared.

INPLASY registration number: INPLASY202410002

Amendments - This protocol was registered with the International Platform of Registered Systematic Review and Meta-Analysis Protocols (INPLASY) on 02 January 2024 and was last updated on 02 January 2024.

INTRODUCTION

Review question / Objective Does Autopulse Mechanical Chest Compression Improve Outcomes After Cardiac Arrest? A systemic review and meta-analysis.

Rationale The effectiveness of chest compressions in cardiopulmonary resuscitation (CPR) is a critical determinant of survival and neurological outcomes following cardiac arrest. Traditional manual chest compressions, while effective when performed correctly, are subject to variability in depth, rate, and fatigue-related performance issues among healthcare providers. In recent years, mechanical devices such as the Autopulse have been developed to deliver consistent and uninterrupted chest compressions during CPR.

Given the significance of CPR quality in post-cardiac arrest outcomes, it is imperative to assess whether Autopulse mechanical chest compression offers advantages over manual compressions. Existing studies and evidence are inconclusive, with some suggesting potential benefits while others indicate no significant difference. Therefore, conducting a systematic review and meta-analysis on this subject is warranted for several reasons:

Clinical Relevance: Cardiac arrest remains a leading cause of mortality worldwide. The question of whether Autopulse mechanical chest compression can improve outcomes directly impacts clinical practice and patient survival.

Resource Allocation: Hospitals and healthcare institutions invest considerable resources in acquiring and maintaining mechanical chest compression devices. An evidence-based assessment of their efficacy is essential for informed resource allocation.

Variability in Research Findings: The current literature contains conflicting findings regarding the impact of Autopulse on outcomes after cardiac arrest. A systematic review and meta-analysis will help synthesize available evidence and clarify the overall effect.

Ethical Considerations: Given the ethical implications of using an intervention that could potentially impact patient survival and quality of life, a thorough and objective evaluation is ethically justified.
Knowledge Advancement: Academic research plays a crucial role in advancing medical knowledge. Conducting a systematic review and meta-analysis will contribute to the academic discourse on CPR techniques and may guide future research efforts.
In summary, the research question regarding Autopulse mechanical chest compression's impact on outcomes after cardiac arrest holds significant clinical, resource, ethical, and academic relevance. Conducting a systematic review and meta-analysis will provide a comprehensive assessment of the available evidence, facilitating evidence-based decision-making in clinical practice and advancing our understanding of CPR interventions.

Condition being studied The condition being studied in this research is "cardiac arrest." Cardiac arrest refers to the sudden cessation of the heart's effective pumping function, resulting in the absence of blood circulation. This condition is a life-threatening medical emergency characterized by the abrupt loss of consciousness, absence of pulse, and cessation of normal breathing. Cardiac arrest can be caused by various factors, including cardiac arrhythmias, heart attacks, respiratory failure, and other underlying medical conditions. Immediate intervention, such as cardiopulmonary resuscitation (CPR) and defibrillation, is critical to restoring normal cardiac function and improving the chances of survival. The research focuses on assessing the impact of Autopulse mechanical chest compression in improving outcomes for individuals who experience cardiac arrest.

METHODS

Search strategy A pre-established protocol was employed, adhering to the guidelines outlined in the Preferred Reporting Items for Systematic Reviews and Metaanalyses (PRISMA) statement, ensuring transparency and replicability in our literature search and synthesis. The review protocol has been duly registered in Inplasy under the registration number 2394295230. We conducted a comprehensive search across multiple databases, namely PubMed, Embase, Scopus, Google Scholar, CINAHL, and the Cochrane Library, encompassing articles published up to December 2023. Within all electronic databases, we implemented a meticulously designed search strategy, querying the following key terms (in the title/abstract, keywords, and their associated MeSH subheadings) with appropriate constraints: "Cardiopulmonary resuscitation" AND "out-of- hospital cardiac arrests" AND "AutoPulse devices" AND "return of spontaneous circulation." To further ensure completeness, we meticulously examined the reference lists of the included studies and relevant reviews identified through our search. We also explored available gray literature, thus striving for comprehensive coverage and saturation in our investigation.

Participant or population Adult and Pediatric patients.

Intervention Mechanical Chest Compressions for Cardiac Arrest.

Comparator Manual Chest Compressions for Cardiac Arrest.

Study designs to be included All type of studies.

Eligibility criteria 1. We focused on research involving adults, specifically those aged 18 years or older, who had experienced cardiac arrests outside of a hospital setting.2. These studies compared the outcomes of utilizing AutoPulse devices versus manual chest compressions.3. We did not limit our selection to any particular language or country; studies from any linguistic background and country with advanced EMS services were eligible for inclusion.4. Excluded from consideration were case reports, narrative reviews, commentaries, letters, abstracts, studies that used mannequins or animals, and investigations involving mechanical devices other than AutoPulse for resuscitation.5. Our interest centered on patients in non-traumatic situations who received chest compressions through mechanical devices, while the control group consisted of similar patients receiving manual chest compressions. This approach allowed us to comprehensively assess the effectiveness of AutoPulse compared to manual methods in out-of-hospital cardiac arrest scenarios.

Information sources PubMed: As a reputable database for biomedical literature, PubMed contains a vast collection of peer-reviewed articles, systematic reviews, and meta-analyses related to cardiac arrest, CPR, and the use of Autopulse mechanical chest compression.
Cochrane Library: The Cochrane Library is a valuable resource for systematic reviews and meta-analyses, offering a comprehensive examination of existing research on various medical interventions, including those relevant to cardiac arrest and resuscitation.

American Heart Association (AHA) Guidelines: The AHA publishes guidelines and scientific statements related to CPR and resuscitation techniques. These documents provide authoritative recommendations based on the latest research findings.
European Resuscitation Council (ERC) Guidelines: Similar to the AHA, the ERC issues guidelines and updates related to resuscitation practices in Europe. These guidelines are valuable for a comprehensive view of international best practices.
Journals: Peer-reviewed academic journals in the fields of cardiology, emergency medicine, and critical care medicine often contain original research articles and reviews on the effectiveness of Autopulse and other mechanical chest compression devices.
Conference Proceedings: Research presented at conferences such as the American Heart Association Scientific Sessions or the European Resuscitation Congress may provide valuable insights into ongoing studies and recent developments in the field.
Clinical Trials Registries: Websites like ClinicalTrials.gov can offer information on ongoing and completed clinical trials related to Autopulse and its impact on cardiac arrest outcomes.
Medical Textbooks: Relevant medical textbooks on topics such as cardiology, emergency medicine, and critical care may offer comprehensive background information on cardiac arrest and resuscitation techniques.
Expert Consultations: Engaging with experts in the field, such as medical professionals specializing in emergency medicine or cardiology, can provide valuable insights and recommendations for key research sources.
Institutional Libraries: Your academic institution's library may grant access to a variety of online databases, journals, and textbooks, enabling you to access a wide range of research materials.

Main outcome(s) Survival Rates: The primary outcome measure involves evaluating the survival rates of individuals who received Autopulse mechanical chest compression compared to those who received manual chest compressions. Survival may be measured at specific time points, such as survival to hospital admission, survival to hospital discharge, and long-term survival rates.
Neurological Function: Neurological outcomes are a critical aspect of post-cardiac arrest care. This research aims to assess the neurological function of survivors, utilizing standardized measures such as the Cerebral Performance Category (CPC) scale to determine the extent of neurological impairment.

Additional outcome(s) Quality of Life: The study may also examine the quality of life of survivors who received Autopulse mechanical chest compression. Quality of life assessments can encompass physical, emotional, and social well-being, and may include tools such as health-related quality of life questionnaires.
Complication Rates: Another key outcome is the assessment of complications or adverse events associated with the use of Autopulse mechanical chest compression. This includes evaluating any injuries or complications related to the device itself or its application during CPR.
Hospital Length of Stay: The duration of hospitalization following cardiac arrest can be an important outcome. Researchers may investigate whether the use of Autopulse impacts the length of stay in intensive care units or hospitals.
Cost-Effectiveness: Cost-effectiveness analysis may be conducted to assess the economic implications of using Autopulse mechanical chest compression in terms of healthcare resource utilization, hospital costs, and potential savings.

Data management Data Management Protocol
Data Collection and Entry: Collect research data accurately and consistently.
Data Storage: Securely store data in digital or physical formats.
Data Organization: Categorize and organize data logically with standardized naming and metadata.
Data Retrieval: Facilitate easy data retrieval with searchable databases and indexing.
Data Security: Implement access controls, encryption, and backup procedures.
Version Control: Track changes and revisions with version control mechanisms.
Documentation and Metadata: Document data collection methods and metadata comprehensively.
Data Preservation: Archive data for long-term availability and accessibility.
Compliance with Regulations: Adhere to ethical and legal data management guidelines.
Data Sharing: Utilize data sharing mechanisms and repositories for collaboration and dissemination.
Data Analysis Tools: Integrate specialized data analysis tools and software into the workflow.
Data Backup and Disaster Recovery: Regularly back up data and have disaster recovery plans in place.

Quality assessment / Risk of bias analysis Risk of Bias Assessment - The included studies were thoroughly assessed using the Cochrane Quality Rating Scale and the Newcastle Ottawa Scale (NOS) adopted by Zhu et al. (2019). RCTs (randomized controlled trials) were assessed using

the Cochrane scale, which evaluates random sequence generation, randomized concealment, blinding procedures, and outcome description . The NOS scale was applied for observational studies, considering criteria such as cohort/case selection, comparability between groups, and outcome/exposure reporting, with a potential score of 9 stars (represented as points). A study could be awarded a maximum of 4 stars for the Selection category, three stars for the Outcome/Exposure category, and a maximum of 2 stars for comparability.

Strategy of data synthesis Systematic Review and Meta-analysis Data Synthesis Strategy.
Literature Selection: Carefully select relevant studies for inclusion in the review.
Data Extraction: Extract pertinent data from selected studies, including study characteristics and outcome measures.
Quality Assessment: Evaluate the quality of each study using established criteria.
Quantitative Analysis: Perform a meta-analysis, quantifying data using statistical techniques such as effect size estimation and pooling.
Forest Plots: Create forest plots to visualize the combined effect sizes and their confidence intervals.
Heterogeneity Assessment: Assess heterogeneity among studies to determine the appropriateness of meta-analysis.
Subgroup Analysis: Conduct subgroup analyses to explore potential sources of heterogeneity.
Sensitivity Analysis: Perform sensitivity analyses to test the robustness of the results.
Publication Bias Assessment: Evaluate publication bias using methods like funnel plots or statistical tests.
Synthesize Findings: Synthesize the results of individual studies to draw overall conclusions.
Report Results: Present the synthesized data and findings in a clear and structured manner, adhering to reporting guidelines for systematic reviews and meta-analyses.
Conclusion: Formulate a conclusion based on the synthesized evidence, highlighting the implications for the research question.

Subgroup analysis No Subgroup analysis.

Sensitivity analysis Meta-analysis Sensitivity Analysis Protocol
Variable Identification: Identify key variables that may impact the meta-analysis, such as inclusion criteria, statistical methods, or data transformation techniques.
Alternative Scenarios: Define alternative scenarios for each key variable, specifying variations in criteria or methods (e.g., different effect size estimators or subgroup definitions).
Data Reanalysis: Reanalyze the pooled data for each scenario while maintaining consistency in data extraction and analysis procedures.
Comparison of Results: Compare the results obtained from different sensitivity scenarios to assess their impact on effect sizes, heterogeneity statistics, and overall conclusions.
Quantify Impact: Quantify the impact of sensitivity analyses by reporting relevant statistics for each scenario, including effect size estimates, confidence intervals, and heterogeneity measures.
Interpretation of Findings: Interpret the findings, highlighting which key variables have the most significant influence and whether variations affect the overall conclusions.
Robustness Assessment: Evaluate the robustness of the meta-analysis results by assessing the consistency of findings across sensitivity scenarios.
Transparent Reporting: Report the sensitivity analysis process and outcomes transparently in the meta-analysis report, ensuring clarity and reproducibility.

Language restriction English.

Country(ies) involved Saudi Arabia.

Keywords Cardiac arrest, Cardiopulmonary resuscitation, Device, Meta-analysis.

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