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Systematic Review on the Management of Pulseless Ventricular Fibrillation and Pulseless Ventricular Tachycardia with Expert Commentary

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ADMINISTRATIVE INFORMATION

Support - No.

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Conflicts of interest - None declared.

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Amendments - This protocol was registered with the International Platform of Registered Systematic Review and Meta-Analysis Protocols (INPLASY) on 2 May 2026 and was last updated on 2 May 2026.

INTRODUCTION

Review question / Objective To systematically evaluate current evidence on management strategies for pulseless ventricular fibrillation and pulseless ventricular tachycardia, including defibrillation techniques, antiarrhythmic therapy, beta-blockade, vasopressor timing, magnesium administration, and extracorporeal cardiopulmonary resuscitation, and to explore the hypothesis that point-of-care ultrasound may identify cardiac mechanical activity in presumed pulseless ventricular tachycardia, suggesting low-output ventricular tachycardia potentially amenable to synchronized cardioversion.

Rationale Pulseless ventricular fibrillation and pulseless ventricular tachycardia are the most common initial shockable rhythms in cardiac arrest, yet survival remains low despite established resuscitation algorithms. A substantial proportion of patients develop refractory VF/pVT after repeated defibrillation, which is associated with poor neurological and survival outcomes. Multiple alternative strategies have been proposed, including modified defibrillation techniques, antiarrhythmic therapy, beta-blockade, vasopressor optimization, and extracorporeal cardiopulmonary resuscitation; however, evidence remains heterogeneous and practice varies across systems.

In addition, current algorithms assume absence of cardiac output in all pulseless shockable rhythms, although emerging evidence from point-of-care ultrasound suggests that a subset of patients may retain cardiac mechanical activity despite absent palpable pulse, representing low-output ventricular tachycardia. This potential misclassification has important therapeutic implications and remains underexplored. Therefore, a comprehensive synthesis of available evidence focusing specifically on VF/pVT management, alongside evaluation of ultrasound-guided physiologic classification, is warranted to clarify current evidence, identify gaps, and inform future research directions.

Condition being studied Pulseless ventricular fibrillation and pulseless ventricular tachycardia in cardiac arrest, including refractory shockable rhythms following failed defibrillation attempts.

METHODS

Search strategy PubMed, Web of Science, Cochrane Library, Scopus, Embase, and Google Scholar were searched from database inception to February 15, 2026. No search limits or filters were applied.

The search strategy combined controlled vocabulary terms and free-text keywords related to pulseless ventricular fibrillation, pulseless ventricular tachycardia, cardiac arrest, refractory ventricular fibrillation, defibrillation strategies, antiarrhythmic drugs, beta-blockers, vasopressors, magnesium sulfate, and extracorporeal cardiopulmonary resuscitation. Reference lists of relevant studies and reviews were also screened.

Participant or population Patients with cardiac arrest presenting with pulseless ventricular fibrillation or pulseless ventricular tachycardia, including both out-of-hospital and in-hospital settings, and including refractory cases following failed defibrillation attempts.

Intervention Defibrillation strategies (including standard defibrillation, double sequential external defibrillation, and vector-change defibrillation), antiarrhythmic therapy (amiodarone, lidocaine), beta-blockade (e.g., esmolol), vasopressor strategies (epinephrine timing and dosing), magnesium sulfate administration, and extracorporeal cardiopulmonary resuscitation.

Comparator Standard advanced cardiac life support management or conventional therapy, including standard defibrillation compared with alternative defibrillation strategies, amiodarone compared with lidocaine, beta-blocker use compared with no beta-blockade, different vasopressor timing or dosing strategies, magnesium sulfate compared with placebo or no magnesium, and extracorporeal cardiopulmonary resuscitation compared with conventional cardiopulmonary resuscitation.

Study designs to be included Randomized controlled trials, cohort studies, registry-based analyses, and observational studies evaluating interventions for pulseless ventricular fibrillation or pulseless ventricular tachycardia and reporting clinical outcomes.

Eligibility criteria Studies evaluating interventions for the management of pulseless ventricular fibrillation or pulseless ventricular tachycardia in cardiac arrest were included. Eligible designs were randomized controlled trials, cohort studies, registry-based analyses, and observational studies reporting at least one clinical outcome, including return of spontaneous circulation, survival to hospital admission or discharge, or neurological outcomes. Interventions of interest included defibrillation strategies, antiarrhythmic medications, beta-blockers, vasopressors, magnesium sulfate, and extracorporeal cardiopulmonary resuscitation.

Studies were excluded if they were reviews, editorials, case reports, conference abstracts without full text, animal studies, or did not specifically evaluate pulseless ventricular fibrillation or pulseless ventricular tachycardia management. Studies with overlapping populations or insufficient outcome data were also excluded.

Information sources Electronic databases including PubMed (MEDLINE), Web of Science, Scopus, Embase, Cochrane Library, and Google Scholar were searched from database inception to February 15, 2026. No restrictions on language, publication status, or study design filters were applied during the search.

Reference lists of included studies and relevant reviews were manually screened to identify additional eligible studies. Grey literature was explored through Google Scholar to capture potentially relevant studies not indexed in major databases.

No direct contact with study authors or trial investigators was planned. Clinical trial registries were not systematically searched.

Main outcome(s) Primary outcomes include return of spontaneous circulation, survival to hospital admission or hospital discharge, and favorable neurological outcomes.

Additional outcome(s) Secondary outcomes include 24-hour survival, survival at 30 days or longer-term follow-up, sustained return of spontaneous circulation, termination of ventricular fibrillation, need for additional defibrillation attempts, and complications related to interventions, including arrhythmias, hypotension, or adverse drug effects.

Data management All identified records were imported into reference management software, and duplicate records were removed. Screening of titles and abstracts, followed by full-text assessment, was performed independently by two reviewers. Data were extracted independently using a standardized Excel data extraction form that captured study characteristics, interventions, comparators, outcomes, and key results.

Discrepancies during screening and data extraction were resolved through discussion, with involvement of a third reviewer when consensus was not reached. Extracted data were organized and stored securely in shared files to ensure accuracy and reproducibility.

Quality assessment / Risk of bias analysis Risk of bias was assessed independently by multiple reviewers using validated tools according to study design. The Cochrane Risk of Bias 2 (RoB 2) tool was used for randomized controlled trials, and the Risk Of Bias In Non-randomized Studies of Interventions (ROBINS-I) tool was used for observational studies.

The RoB 2 tool evaluates bias arising from the randomization process, deviations from intended interventions, missing outcome data, measurement of outcomes, and selection of reported results. The ROBINS-I tool assesses bias due to confounding, selection of participants, classification of interventions, deviations from intended interventions, missing data, measurement of outcomes, and selection of reported results.

Assessments were conducted independently, and any disagreements were resolved through discussion and consensus.

Strategy of data synthesis A narrative synthesis approach will be used to summarize the findings of the included studies. Studies will be grouped according to intervention domains, including defibrillation strategies, antiarrhythmic therapy, beta-blockade, vasopressor strategies, magnesium administration, and extracorporeal cardiopulmonary resuscitation.

Key study characteristics and outcomes will be summarized in structured tables. Results will be described qualitatively, focusing on clinical outcomes such as return of spontaneous circulation, survival, and neurological outcomes. Due to expected heterogeneity in study designs, populations, and interventions, quantitative meta-analysis is not planned.

Subgroup analysis Subgroup analyses will be performed where sufficient data are available based on intervention domains (defibrillation strategies, antiarrhythmic therapy, beta-blockade, vasopressor strategies, magnesium administration, and extracorporeal cardiopulmonary resuscitation), clinical setting (out-of-hospital versus in-hospital cardiac arrest), and timing of interventions (e.g., early versus delayed administration).

Additional subgroup considerations may include refractory versus non-refractory ventricular fibrillation or pulseless ventricular tachycardia and differences in intervention protocols across studies.

Sensitivity analysis Sensitivity analysis is not planned because quantitative meta-analysis will not be performed. However, the robustness of findings will be considered narratively by examining study design, risk of bias, sample size, and consistency of results across included studies.

Language restriction No language restrictions will be applied.

Country(ies) involved Saudi Arabia.

Keywords Cardiac arrest; Pulseless ventricular fibrillation; Pulseless ventricular tachycardia; Defibrillation; Antiarrhythmic therapy; Beta-blockers; Vasopressors; Extracorporeal cardiopulmonary resuscitation; Point-of-care ultrasound.

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