

INPLASY

EVALUATION OF AIRWAY MANAGEMENT TECHNIQUES AFTER PEDIATRIC OUT-OF-HOSPITAL CARDIAC ARREST: A SYSTEMATIC REVIEW AND META-ANALYSIS

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ADMINISTRATIVE INFORMATION

Support - This study has no financial support.

Review Stage at time of this submission - Preliminary searches.

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 7 May 2026 and was last updated on 7 May 2026.

INTRODUCTION

Review question / Objective This systematic review aims to evaluate the impact of different airway management strategies used during pediatric out-of-hospital cardiac arrest on survival and neurological outcomes. The review will compare bag-valve-mask ventilation (BVM), supraglottic airway devices (SGA), and endotracheal intubation (ETI) in children and adolescents aged 0 to 18 years. Using the PICOS framework:
Population (P): Pediatric patients (0–18 years) with out-of-hospital cardiac arrest.
Intervention (I): Airway management techniques during cardiopulmonary resuscitation, including endotracheal intubation, supraglottic airway devices, and bag-valve-mask ventilation.
Comparator (C): Comparison between different airway management strategies.
Outcomes (O): Return of spontaneous circulation (ROSC), short-term survival, medium-term survival, survival to hospital discharge, and neurological or neurocognitive outcomes.

Study design (S): Observational studies, cohort studies, case-control studies, retrospective studies, prospective studies, and pilot studies. The objective of this review is to synthesize the available evidence regarding the effectiveness and safety of airway management methods in pediatric out-of-hospital cardiac arrest and to identify which strategies are associated with better clinical and neurocognitive outcomes.

Condition being studied Pediatric out-of-hospital cardiac arrest (OHCA) is a life-threatening emergency characterized by the abrupt cessation of cardiac mechanical activity occurring outside the hospital setting. Although relatively uncommon compared with adult cardiac arrest, pediatric OHCA is associated with high mortality rates and significant neurological morbidity among survivors. Unlike adult cardiac arrest, which is frequently related to primary cardiac arrhythmias, pediatric cardiac arrest is commonly secondary to respiratory failure and hypoxia. Therefore, adequate oxygenation and airway management are essential components of pediatric

cardiopulmonary resuscitation. Several airway management strategies are currently used during pediatric resuscitation, including bag-valve-mask ventilation (BVM), supraglottic airway devices (SGA), and endotracheal intubation (ETI). However, the superiority of one technique over another remains controversial. While ETI is traditionally considered the definitive airway management approach, it requires technical expertise and may be associated with complications such as esophageal intubation, interruption of chest compressions, hypoxemia, and airway trauma. Conversely, BVM is widely accessible and rapidly applicable but may lead to inadequate ventilation and aspiration. SGAs have emerged as alternative devices that may facilitate airway management while minimizing procedural interruptions. In addition to survival outcomes, airway management strategies may directly influence neurological and neurocognitive recovery, since prolonged hypoxia can result in brain injury affecting memory, cognition, behavior, and motor function. Given the limited and conflicting evidence regarding the effectiveness and safety of airway management methods in pediatric OHCA, a systematic review is necessary to synthesize the available literature and support evidence-based clinical decision-making in pediatric emergency care.

METHODS

Search strategy Systematic searches will be conducted in the following electronic databases: PubMed/MEDLINE, Embase, LILACS, and the Cochrane Library. Additional manual searches will be performed in the reference lists of eligible studies and relevant reviews to identify potentially relevant articles not retrieved through the electronic search. No restrictions regarding language or year of publication will be applied. Only studies involving human participants will be included. The search strategy will be based on Medical Subject Headings (MeSH), Emtree terms, and related keywords associated with pediatric cardiac arrest and airway management. The preliminary search strategy for PubMed/MEDLINE will include the following terms: ("cardiac arrest" OR "out-of-hospital cardiac arrest" OR "cardiopulmonary arrest") AND ("pediatric" OR "child" OR "children" OR "infant" OR "adolescent") AND ("airway management" OR "endotracheal intubation" OR "bag-valve-mask ventilation" OR "bag mask ventilation" OR "supraglottic airway" OR "laryngeal mask airway"). The search strategy will be adapted according to the indexing terms and syntax requirements of each database. Study selection and screening will be independently conducted by two reviewers using the Rayyan

platform. Disagreements will be resolved by a third reviewer.

Participant or population This review will include studies involving pediatric patients aged 0 to 18 years who experienced out-of-hospital cardiac arrest. Eligible participants may include neonates, infants, children, and adolescents who underwent cardiopulmonary resuscitation and received airway management interventions during emergency care. Studies including mixed populations will only be considered if pediatric data are reported separately. Participants may have undergone different airway management techniques, including bag-valve-mask ventilation (BVM), supraglottic airway devices (SGA), or endotracheal intubation (ETI). There will be no restrictions regarding sex, ethnicity, geographic location, or underlying cause of cardiac arrest.

Intervention The intervention of interest in this systematic review is airway management performed during pediatric out-of-hospital cardiac arrest. The airway management strategies evaluated will include: Bag-valve-mask ventilation (BVM); Supraglottic airway devices (SGA); Endotracheal intubation (ETI). The review aims to assess the impact of these airway management techniques on clinical outcomes, including return of spontaneous circulation (ROSC), short- and medium-term survival, survival to hospital discharge, and neurological or neurocognitive outcomes. Studies evaluating one or more of these airway management methods during pediatric cardiopulmonary resuscitation will be considered eligible for inclusion.

Comparator The comparator will consist of comparisons between different airway management strategies used during pediatric out-of-hospital cardiac arrest. Comparisons may include: Bag-valve-mask ventilation (BVM) versus endotracheal intubation (ETI); Supraglottic airway devices (SGA) versus endotracheal intubation (ETI); Bag-valve-mask ventilation (BVM) versus supraglottic airway devices (SGA); Studies comparing all three airway management techniques. The review will evaluate differences in survival and neurological outcomes according to the airway management method used during cardiopulmonary resuscitation.

Study designs to be included Observational studies, cohort studies, case-control studies, prospective studies, retrospective studies, and pilot studies evaluating airway management strategies during pediatric out-of-hospital cardiac arrest will be included. Studies must report clinical

outcomes related to survival or neurological/neurocognitive status. Case reports, case series, editorials, letters, reviews, conference abstracts without full data, and animal studies will be excluded.

Eligibility criteria Studies involving mixed populations without separate pediatric data will be excluded. Only studies evaluating out-of-hospital cardiac arrest will be considered. Studies must clearly describe the airway management strategy used during cardiopulmonary resuscitation and report at least one clinical or neurological outcome. No language or publication year restrictions will be applied. Only studies involving human participants will be included.

Information sources The electronic databases used for this systematic review will include PubMed/MEDLINE, Embase, LILACS, and the Cochrane Library. Additional manual searches will be conducted in the reference lists of eligible studies and relevant review articles to identify potentially relevant publications not retrieved through the electronic search strategy.

Gray literature may also be consulted when applicable. When important data are missing or unclear, the corresponding authors of the primary studies may be contacted for additional information.

All searches will be conducted without language or publication year restrictions and will be limited to studies involving human participants.

Main outcome(s) The primary outcomes of this systematic review will include return of spontaneous circulation (ROSC), short-term survival, medium-term survival, survival to hospital discharge, and neurological or neurocognitive outcomes in pediatric patients following out-of-hospital cardiac arrest.

Neurological outcomes may include validated scales such as the Pediatric Cerebral Performance Category (PCPC) when available.

Secondary outcomes may include airway-related complications, aspiration, hypoxemia, esophageal intubation, and pneumonia associated with airway management techniques.

The main effect measures will include odds ratios (OR), relative risks (RR), standardized mean differences (SMD), and 95% confidence intervals (CI). When feasible, meta-analysis will be performed to synthesize pooled effect estimates across studies.

Quality assessment / Risk of bias analysis The methodological quality and risk of bias of the included studies will be assessed according to the

study design. Since observational studies are expected to predominate, the Newcastle-Ottawa Scale (NOS) will be used for cohort and case-control studies.

The NOS evaluates three main domains: selection of study groups, comparability between groups, and assessment of outcomes or exposures. Studies scoring 7–9 stars will be considered high quality, 4–6 stars moderate quality, and ≤ 3 stars low quality with high risk of bias.

The assessment will be independently conducted by two reviewers, and disagreements will be resolved by discussion with a third reviewer.

Strategy of data synthesis Data synthesis will be performed through qualitative analysis and, when appropriate, quantitative meta-analysis. The results will be summarized using tables, narrative synthesis, and forest plots.

For dichotomous outcomes, odds ratios (OR) or relative risks (RR) with 95% confidence intervals (CI) will be calculated. For continuous outcomes, standardized mean differences (SMD) with 95% confidence intervals will be used.

Heterogeneity among studies will be assessed using the I^2 statistic. A fixed-effects model will be applied when heterogeneity is low, whereas a random-effects model will be used when heterogeneity exceeds 40%.

Studies may be grouped according to airway management strategy, including bag-valve-mask ventilation, supraglottic airway devices, and endotracheal intubation, as well as according to clinical outcomes.

All statistical analyses will be conducted using Review Manager (RevMan) version 5.4. If meta-analysis is not feasible due to heterogeneity or insufficient data, a narrative synthesis will be presented.

Subgroup analysis Subgroup analyses may be performed according to the type of airway management strategy used during pediatric out-of-hospital cardiac arrest, including bag-valve-mask ventilation (BVM), supraglottic airway devices (SGA), and endotracheal intubation (ETI).

Additional subgroup analyses may include age group, survival outcome evaluated, neurological or neurocognitive assessment method, and study design.

If sufficient data are available, analyses according to timing of intervention and professional performing the airway management may also be conducted.

Sensitivity analysis Sensitivity analyses will be performed to evaluate the robustness and stability of the pooled results. Leave-one-out analysis will

be conducted by sequentially removing individual studies to assess their influence on the overall effect estimates.

Additional sensitivity analyses may include exclusion of studies with high risk of bias, studies with small sample sizes, and analyses comparing fixed-effects versus random-effects models.

If significant differences are observed, potential sources of heterogeneity and methodological limitations will be discussed.

Country(ies) involved Brazil – University of the Extreme South of Santa Catarina (UNESC).

Keywords Cardiac arrest; Pediatrics; Airway management; Endotracheal intubation; Supraglottic airway; Systematic review.

Contributions of each author

Author 1 - Gabriele Prestes - Supervised all stages of the protocol development, critically reviewed the manuscript, and approved the final version of the protocol.

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Author 2 - Bianca Goulart - Contributed to the conceptualization of the study, literature review, development of the search strategy, and drafting of the protocol.

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