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Performance metrics in cardiac resuscitation: Rapid cycle deliberate practice (RCDP) versus simulated clinical experience (SCE)

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Abstract:

BACKGROUND: Cardiovascular diseases (CVDs) remain the leading cause of mortality globally, with sudden cardiac arrest (SCA) due to ventricular tachyarrhythmias accounting for nearly 25% of cardiovascular deaths. Effective simulation-based training is critical for improving clinical performance and outcomes in cardiac emergencies. Simulated Clinical Experience (SCE) and Rapid Cycle Deliberate Practice (RCDP) are two structured instructional methods. This study explores which method is more effective in managing cardiac arrest. To compare the effectiveness of RCDP and SCE in improving performance metrics in the management of cardiac arrhythmias.

MATERIALS AND METHODS: This pre–post interventional study was conducted among healthcare professionals trained in Advanced Cardiovascular Life Support (ACLS). Participants (n = 240) were divided into two equal groups and underwent two simulation scenarios (one baseline and one post-instruction). Key metrics assessed included time to rhythm recognition, initiation of CPR, defibrillation, and identification of Return of Spontaneous Circulation (ROSC). While the SCE group received traditional post-scenario debriefing, the RCDP group underwent sessions with embedded facilitator feedback. Facilitators were blinded to group allocation during assessments.

RESULTS: The RCDP group showed significantly faster response times across all measured metrics, along with reduced variability and improved Chest Compression Fractions (P value = 0.018) and ROSC identification (P value = 0.003). SCE participants demonstrated improvement, though outcomes were modest. The iterative feedback and repetitive structure of RCDP likely contributed to superior outcomes.

CONCLUSION: RCDP offers measurable benefits in enhancing resuscitation performance. However, both methods contribute to skill development.

Keywords:

Advanced Cardiac Life Support, debriefing, deliberate practice, resuscitation protocol, simulation training

Introduction

As per the World Health Organization (WHO), cardiovascular diseases (CVD) are a leading cause of mortality worldwide, claiming over 18 million lives annually, with more than 75% of these deaths occurring in low- and middle-income countries.[1] Ventricular tachyarrhythmias, the most common complication of CVD, remain a major cause of sudden cardiac arrest (SCA), accounting for nearly 25% of cardiovascular deaths each year.[2] SCA is characterized by hemodynamic collapse due to the disruption of normal heart rhythm.[3,4]

Timely recognition of cardiac arrest, immediate initiation of Cardiopulmonary

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Resuscitation (CPR), and rapid defibrillation and transportation forms the important link in the "chain of survival."[5] Regular skills upgradation and training are important for providing timely and effective patient care and play an important role in improving patient outcomes.[6,7] Continuous learning ensures that the healthcare professionals remain up-to-date with the current best practices, advancements, and techniques, resulting in reduced medical errors and improved patient outcomes.

The healthcare providers, including Emergency Medical Professionals working in ambulances, doctors, and nurses working in Emergency rooms of hospitals, are often the first responders in such crises. Consequently, it is imperative for these professionals to quickly assess the patient's clinical condition, identify the cardiac rhythm, and initiate appropriate management without delay.

Prehospital care is still in its nascent stages in a resource-constrained country like India. The prehospital settings are often marked by high stress and necessitate immediate action. Limited resources and infrastructure pose significant challenges in providing adequate *in situ* training, which is crucial for optimal performance during emergencies.[8-10]

Simulation-based training methodologies have been found to play a pivotal role in determining the effectiveness of skills retention among healthcare providers, and directly influence patient outcomes.[11] Among the various simulation-based methodologies, Simulated Clinical Experience (SCE) is a form of experiential learning, derived from Kolb's experiential theory, that enables participants to hone their psychomotor, cognitive, and critical decision-making skills in a controlled environment using high- and low-fidelity manikins and equipment, followed by a post-event debriefing.[12] A key component of SCE is post-simulation debriefing, during which facilitators provide feedback and facilitate reflection on performance, thereby promoting skill retention and proficiency. This reflective process aids participants in critically analyzing their actions and decisions, encouraging unlearning and relearning of best practices. Repeated training and exposure to simulated scenarios have been found to enhance proficiency significantly, ultimately leading to better patient outcomes.[13]

However, Rapid Cycle Deliberate Practice (RCDP), a simulation strategy using an iterative instructional method, emphasizes repeated practice and immediate feedback, allowing participants to achieve the necessary skill proficiency.[14] This has been derived from Dr. Anders Ericsson's research on deliberate practice, wherein simulation scenarios are paused at critical moments for imparting corrective feedback, thereby enabling participants to refine their techniques in real time.[15] While RCDP has demonstrated promise in pediatric resuscitation training and airway management by fostering skill mastery, its application to adult cardiac emergencies remains underexplored.[16-20]

The dire need for effective training methodologies in cardiac emergencies cannot be overstated. Performance metrics, including time taken to recognize cardiac rhythms, initiate CPR, and administer shock, are key indicators of training effectiveness.[21] In addition, the ability to quickly resume CPR after delivering a shock is pivotal, as it helps maintain cerebral and coronary perfusion, which is essential for patient survival.[22] Another key performance indicator is identification of Return of Spontaneous Circulation (ROSC), which indicates the resumption of a sustained heart rhythm after cardiac arrest, and is vital for guiding subsequent interventions, including advanced airway management and the administration of post-cardiac arrest care protocols. Adherence to American Heart Association (AHA) Advanced Cardiac Life Support (ACLS) algorithms throughout a cardiac event have been associated with increased survival rates for cardiac arrest patients.[23,24]

In an era where effective emergency response can mean the difference between life and death, the choice of training methodology becomes not only a matter of academic interest but a crucial factor in saving lives.

The study aims to discern which methodology offers better outcomes for healthcare professionals in managing cardiac resuscitation.

Objective: To determine the performance metrics in managing cardiac arrhythmias by using Rapid Cycle Deliberate Practice (RCDP) and Simulated Clinical Experience (SCE).

Materials and Methods

Study design and setting

The study examines knowledge retention and practical performance of healthcare professionals in managing cardiac arrhythmias by comparing two simulation-based training methodologies: RCDP and SCE.

Key performance metrics focused on the initial assessment of the patient (measured in minutes), time taken to recognize cardiac rhythms, initiate Cardiopulmonary Resuscitation (CPR), including the Chest Compression Fraction (CCF), administer defibrillation, and identify Return of Spontaneous Circulation (ROSC) (all measured in seconds).

A high-fidelity manikin was utilized to create clinical simulation scenarios based on cardiac arrhythmias and rhythms of cardiac arrest, including Ventricular Fibrillation (VF), pulseless Ventricular Tachycardia (pVT), Asystole, and Pulseless Electrical Activity (PEA).

The scenarios were derived from the AHA ACLS manual to ensure standardized exposure across participants. The American Heart Association (AHA) Advanced Cardiac Life Support (ACLS) algorithms were utilized for the study.

A dry run was conducted before each session to rule out any technical glitches.

Study participants and sampling

A total of 240 participants, including medical doctors, emergency room (ER) nurses, and intensive care unit (ICU) nurses from various regions of India, were recruited for this study. All participants had prior experience with simulation-based training and held provider certifications in both Basic and Advanced Cardiac Life Support (ACLS) courses from the AHA, USA. While prior real-life resuscitation experience beyond ACLS certification was not formally recorded, a relatively homogenous participant profile was ensured.

Apart from being proficient in skills including basic life support techniques, airway management, triage assessments, and the management of cardiac scenarios, the participants were trained in diverse skills, including providing proper spinal immobilization, conducting triage assessments, and life-saving skills essential for both medical and trauma management.

All participants were randomly assigned to 30 groups, each consisting of eight individuals, through stratified randomization. Fifteen groups were allocated to the SCE methodology, while the other 15 underwent the RCDP approach. Each group participated in two simulation scenarios with a one-week interval, allowing ample time for participants to apply and reflect on their learning from each training methodology.

Data collection tool and technique

Simulation Scenario (Pre).

SCE group: Each simulation session for the SCE group included a structured timeline:

Pre-briefing (15 minutes): Participants received scenario information and self-assigned roles. **Simulation scenario (15 minutes):** Participants engaged in the simulation without facilitator interruption.

Post-event debriefing (30 minutes): Facilitators provided feedback on observed actions, enabling reflection and discussion according to the AHA ACLS algorithm.

RCDP group: For the RCDP group, the session structure differed:

Pre-briefing (15 minutes): Similar to the SCE group.

Simulation scenario (45 minutes): Participants engaged in the simulation wherein the scenario was paused at key moments for real-time feedback and coaching, with integrated micro-debriefings throughout, thereby eliminating the need for a formal post-debriefing session.

Overall, both methodologies comprised a total session time of 60 minutes. Experienced facilitators, qualified as Basic and Advanced Cardiac Life Support instructors and Certified Healthcare Simulation Educators, conducted all sessions.

The study utilized the AHA ACLS algorithm (attached as Appendix 1), a globally recognized protocol for managing arrhythmias, cardiac arrest, and post-cardiac arrest care. The key performance indicators assessed included the time taken to complete essential actions, such as evaluating the appropriateness of the clinical condition, identifying the cardiac rhythm, initiating CPR, and delivering defibrillation shocks. Proficiency was evaluated, and performance metrics were compared between Scenario 1 and Scenario 2 across both instructional methods.

The entire simulation session was video recorded after obtaining consent from all participants. To minimize bias and maintain consistency, the recordings were reviewed by two ACLS-certified facilitators. Although inter-rater reliability was not measured using statistical tools like Cohen's Kappa, both facilitators jointly reviewed the video recording rather than conducting an independent or simultaneous assessment to ensure consistent and fair evaluation of participant performance throughout the sessions.

Ethical consideration

Informed consent was obtained from every participant, and their confidentiality was fully respected.

Statistical analysis

Statistical analysis was performed using several approaches to evaluate improvement in performance between the RCDP and SCE groups:

Descriptive Statistics: The data were summarized using measures of central tendency and dispersion to indicate the average value and its variations. The median and quartiles (1st and 3rd quartiles) were calculated for key performance indicators, such as the time taken for critical actions. The Interquartile Range (IQR) was also computed to assess the variability of performance within each group. Also, reported with a graphical presentation.

Inferential Statistics: The nonparametric Wilcoxon signed-rank test was conducted to compare performance within both SCE and RCDP groups over the paired outcome of the two scenarios. The finding was reported at 5% level of significance.

All data analysis was conducted using SPSS statistical software; the results were presented using tables and figures to provide a comprehensive overview of participant performance and facilitate comparisons between RCDP and SCE methodologies [Figure 1].

Novelty: The novelty of this study lies in its comparative design, performance-focused metrics, and real-time assessment of instructional efficacy in a simulated cardiac arrest setting.

Results

As seen in Figure 2 (pre-training scenario), the time taken for completion of the critical actions was nearly similar for both SCE and RCDP groups.

As depicted in Figure 3 (post-training scenario), the participants who underwent the RCDP intervention demonstrated superior performance as compared to the SCE.

Specifically, the RCDP group exhibited significant improvements in the time taken to resume CPR (RCDP-4.8 sec vs SCE-8 sec) and time taken for identification of ROSC (RCDP-5.25 sec vs SCE-10 sec).

Table 1. This dataset presents descriptive statistics for various clinical performance indicators, comparing two educational interventions: SCE and RCDP, both before and after training. It represents the following details, and each data point includes: 1st Quartile (Q1): 25% of the data falls below this value. Median (Q2): The middle value; 50% of the data is below this. 3rd Quartile (Q3): 75% of the data is below this value, and IQR (Interquartile Range) = Q3–Q1: Measures the spread of the middle 50% of the data.

Assessment Time (to check appropriateness of clinical condition): **Pre:** Both SCE and RCDP have similar values (median = 10 min, IQR = 2.5), and Post: Median time decreases in both groups (SCE: 6.5 min, RCDP: 6 min), indicating improved efficiency. RCDP shows less variability (IQR = 1.0), suggesting more consistent performance.

Recognition of Rhythm: **Pre:** RCDP has a slightly quicker median (8s) vs. SCE (10s), and **Post:** Significant improvement in both, especially RCDP (median = 5.5s), and reduced IQR (3.8s vs. 5.8s), again showing greater consistency.

Time to Administer Shock: Pre: RCDP takes slightly less time, but with more variability, and **Post:** RCDP shows faster and more consistent performance (median = 6s vs. 8s).

Time to Resume CPR After Shock: Post: RCDP (median = 5s) outperforms SCE (median = 8s), with a tighter IQR (1.8s).

Time for Identifying ROSC: Post: RCDP shows a notable improvement (median = 5s vs. 10s for SCE), indicating quicker decision-making.

Chest Compression Fraction (CCF): Post: RCDP leads to better and more consistent CCF (median = 88% vs. 83.5%).

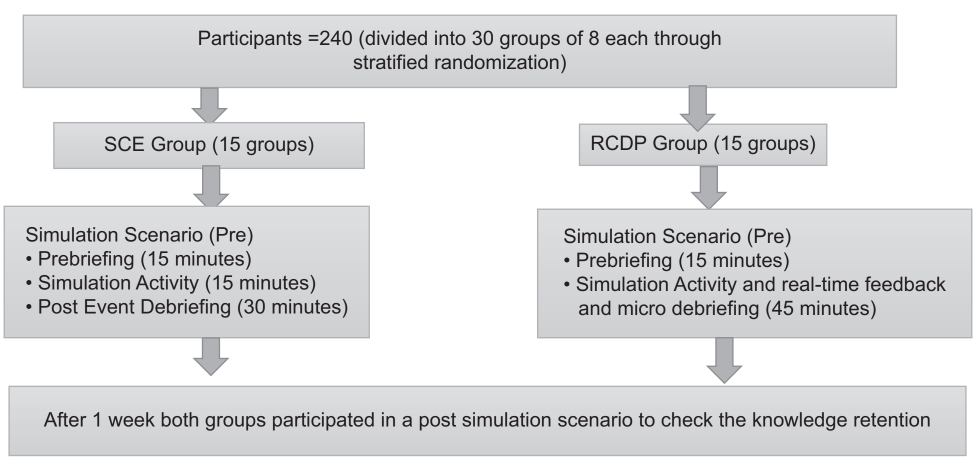

Figure 1: Schematic representation of methodology

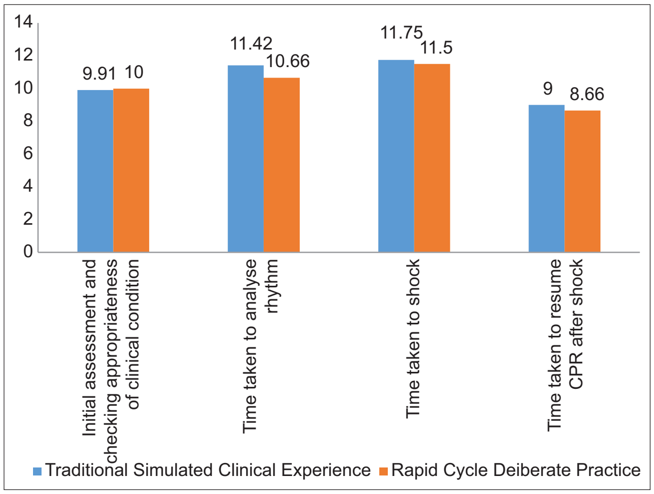

Figure 2: Pre-training scenario: Simulated clinical experience versus rapid cycle deliberate practice

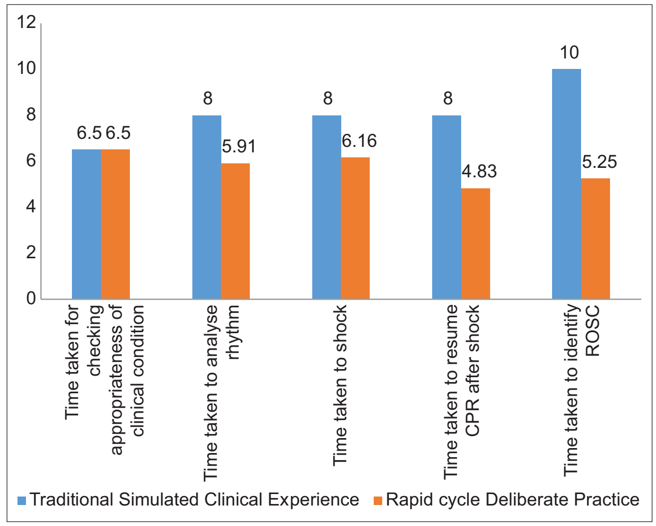

Figure 3: Post training scenario: Simulated clinical experience versus rapid cycle deliberate practice

Table 1: Descriptive statistics

Variable	Group	1st Quartile	Median	3rd Quartile	IQR
Assessment Time (minutes)	SCE (Pre)	9.00	10.00	11.50	2.50
	RCDP (Pre)	9.00	10.00	11.50	2.50
	SCE (Post)	6.00	6.50	8.00	2.00
	RCDP (Post)	6.00	6.00	7.00	1.00
Recognition of Rhythm (seconds)	SCE (Pre)	8.25	10.00	15.00	6.80
	RCDP (Pre)	7.25	8.00	15.00	7.80
	SCE (Post)	5.50	8.00	11.25	5.80
	RCDP (Post)	4.25	5.50	8.00	3.80
Shock Administration Time (seconds)	SCE (Pre)	10.25	12.00	12.00	1.80
	RCDP (Pre)	10.00	10.50	13.50	3.50
	SCE (Post)	8.00	8.00	9.75	1.80
	RCDP (Post)	5.00	6.00	7.00	2.00
Time to Resume CPR (seconds)	SCE (Pre)	6.25	10.00	11.75	5.50
	RCDP (Pre)	6.25	9.50	11.00	4.80
	SCE (Post)	6.25	8.00	10.00	3.80
	RCDP (Post)	4.00	5.00	5.75	1.80
Time to Identify ROSC (seconds)	SCE (Pre)	10.00	12.00	12.00	2.00
	RCDP (Pre)	8.50	12.00	12.00	3.50
	SCE (Post)	8.00	10.00	12.00	4.00
	RCDP (Post)	5.00	5.00	6.00	1.00
Chest Compression Fraction (%)	SCE (Pre)	79.25	81.50	84.75	5.50
	RCDP (Pre)	79.25	81.50	84.75	5.50
	SCE (Post)	81.25	83.50	87.25	6.00
	RCDP (Post)	85.00	88.00	90.00	5.00

SCE=Simulated Clinical Experience, RCDP=Rapid Cycle Deliberate Practice, CPR=Cardiopulmonary Resuscitation, ROSC=Return of Spontaneous Circulation, IQR=Interquartile Range

Therefore, RCDP produced better post-training outcomes across all measured skills. Improvements included faster response times, reduced variability, and higher Chest Compression Fractions. SCE shows progress, but gains were generally smaller, and performance was more variable.

Table 2: This dataset presents the Wilcoxon signed-rank test to compare pre- and post-training performance within both SCE and RCDP groups. All variables except one (CCF in SCE) show statistically significant improvements from Scenario 1 (pre) to Scenario 2 (post) training in both groups. Thus, RCDP consistently demonstrated strong statistical significance, suggesting that it is particularly effective at improving performance across all measured domains. CCF in SCE ($P = 0.066$) did not reach statistical significance, indicating that the observed change could be due to chance

The effectiveness of simulation-based training methods in enhancing clinical performance can be conceptualized using learning theories. Figure 4 illustrates the theoretical framework underlying the study, mapping the instructional strategies to performance outcomes.

Discussion

Timely administration of critical interventions in case of cardiac arrhythmias plays a significant role in determining patient outcomes.[25] This study evaluated the performance of participants trained through RCDP and SCE methodologies by a pre- and post-scenario method using the AHA ACLS algorithm.

Performance of Critical Actions: During the first scenario (pre), participants from both groups demonstrated similar efficiency in administering essential interventions according to the AHA ACLS algorithm. Critical actions, such as assessing clinical conditions, recognizing cardiac rhythms, initiating CPR when necessary, and administering defibrillation, were performed within similar time frames by both groups. This indicates that both instructional strategies were effective in preparing participants to handle such critical emergencies.

During the second scenario (post), across both methodologies, notably less time was taken in

Table 2: Wilcoxon signed-rank test

Variable	Comparison	*P*	Interpretation
Assessment Time	SCE (Post vs Pre)	0.008	Statistically significant performance improvement (time reduced).
	RCDP (Post vs Pre)	0.005	Significant improvement; RCDP also reduced time effectively.
Recognition of Rhythm	SCE (Post vs Pre)	0.003	Significant reduction in time taken to recognize rhythm.
	RCDP (Post vs Pre)	0.007	Also significant improvement in recognition speed.
Time to Administer Shock	SCE (Post vs Pre)	0.005	Statistically significant faster shock delivery post-training.
	RCDP (Post vs Pre)	0.003	Significant improvement; RCDP again shows effectiveness.
Time to Resume CPR	SCE (Post vs Pre)	0.026	Significant reduction in delay to resume CPR.
	RCDP (Post vs Pre)	0.011	Also statistically significant, with better post-training performance.
Time to Identify ROSC	SCE (Post vs Pre)	0.024	Significant improvement in recognizing ROSC faster.
	RCDP (Post vs Pre)	0.003	Stronger statistical improvement.
Chest Compression Fraction (CCF)	SCE (Post vs Pre)	0.066	*Not* statistically significant (P>0.05); improvement is inconclusive.
	RCDP (Post vs Pre)	0.018	Statistically significant improvement in CCF.

SCE=Simulated Clinical Experience, RCDP=Rapid Cycle Deliberate Practice, CPR=Cardiopulmonary Resuscitation, ROSC=Return of Spontaneous Circulation

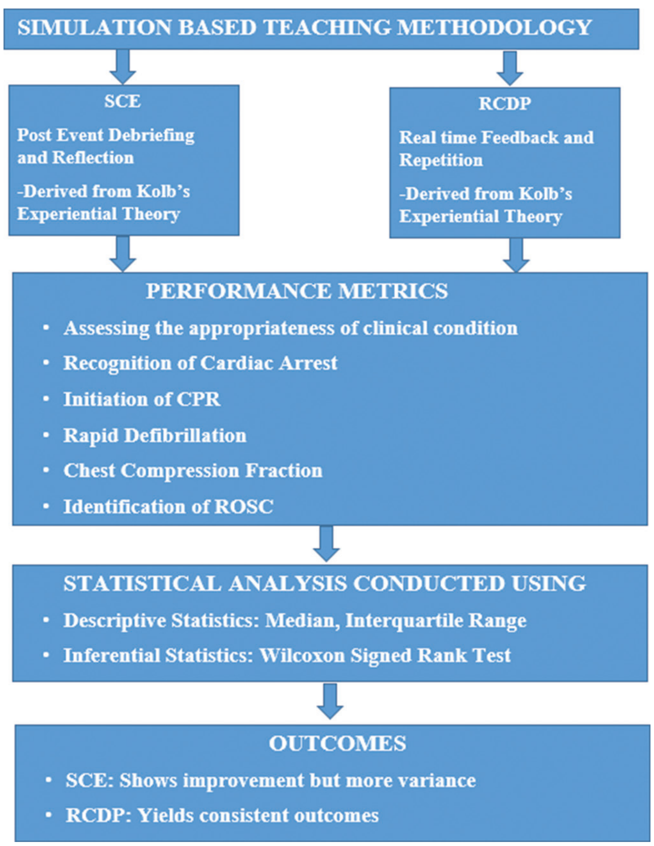

Figure 4: Conceptual figure of the study

comparison with the first scenario to assess the clinical condition, cardiac rhythm recognition, defibrillation, resume CPR, and identification of Return of Spontaneous Circulation (ROSC).

This aligns with the findings of existing literature, suggesting how structured simulation training plays an important role in enhancing procedural proficiency in emergency settings and is effective in familiarizing healthcare providers with critical resuscitation protocols.[26-28]

RCDP versus SCE

While both methodologies showed improvement in their performances in post-training scenario, RCDP group showed consistent improvement across several metrics, viz. faster rhythm recognition (median: 5.5 sec vs 8 sec), prompt and quick administration of shock (median: 6 sec vs 8 sec), and immediate CPR resumption after shock (median: 5 sec vs 8 sec) compared to the SCE group.

Further, the RCDP group showed significant improvement in time taken to identify ROSC ($P = 0.003$) in comparison with the SCE group ($P = 0.024$). The RCDP group demonstrated a statistically significant improvement in achieving the Chest Compression Fraction (CCF) ($P = 0.018$), whereas the SCE group did not reach significance ($P = 0.066$).

Higher CCF has been directly linked with the incidence of ROSC, which in turn is linked to patient survival.[29] RCDP, with its iterative, deliberate feedback, is more effective as compared to SCE.

Mode of instruction

The iterative nature of RCDP helps to consolidate learning, as participants engage in a cyclical series of practice sessions, reflection, and refinement, ultimately enhancing their ability to respond adeptly when faced with real-life emergencies.[30,31]

In contrast, SCE often relies on longer simulation sessions, followed by post-event debriefing. While SCE is beneficial for experiential learning, it may not provide the same level of immediate reinforcement that RCDP offers. There is a high probability for the accumulation of errors over the course of a simulation, which can lead to ingrained incorrect practices that are only addressed later during debriefing. However, if the debriefing does not address the errors, then there is a very high chance of the participants continuing with a flawed mental model.[32]

Challenges in the implementation of ROSC

As highlighted by Perretta *et al*.[33] several aspects of RCDP warrant further exploration, particularly concerning the debriefing style and dynamics involved. While immediate feedback is a cornerstone of RCDP, the quality and specificity of that feedback are crucial.

Facilitators must be trained to provide constructive and specific feedback that can be effectively integrated into practice. However, the intense nature of RCDP can lead to fatigue for both facilitators and participants. Facilitators may find themselves under pressure to maintain high levels of engagement and energy throughout repeated cycles of practice, which can be taxing over time. Participants may also experience cognitive overload due to the fast pace of practice or if they are required to absorb continuous feedback without adequate time.

Hence, attention to duration of session, participant pacing, and psychological safety to maintain engagement and learning efficiency is of utmost importance.

Limitations

The research was conducted within a single institutional and geographic context, limiting generalizability. Moreover, since outcomes were assessed in the immediate post-training phase, future studies exploring long-term retention and application in clinical settings are recommended. Factors, such as cognitive load, participant fatigue, and variability in facilitator feedback, also merit further investigation.

Scope for future research

Future research should investigate the long-term retention of skills and assess whether improvements seen in simulation translate to clinical performance and patient outcomes. Studies should also explore how parameters, such as session pacing, feedback methods, and facilitator fatigue, affect teaching and learning, especially in an intensive instructional method like RCDP. Additionally, evaluating the cost-effectiveness, learner satisfaction, and scalability of blended approaches incorporating both RCDP and SCE can guide the development of more sustainable and inclusive training models.

Conclusion

The findings of this study demonstrate that both instructional methods, viz. RCDP and SCE, are effective in preparing healthcare providers for cardiac emergencies.

While both groups exhibited significant improvements in managing all the critical actions aligned with AHA's ACLS protocols, the iterative and feedback-rich nature of RCDP appears to foster, RCDP group achieved superior outcomes in several metrics, including Time to Resume CPR, recognition of ROSC, and Chest Compression Fraction. In contrast, SCE demonstrated strength in foundational assessment and rhythm recognition skills, suggesting its continued relevance in simulation-based medical education.

These outcomes align with global health policy imperatives, particularly Sustainable Development Goal 3, which emphasizes strengthened emergency preparedness and workforce training to ensure healthy lives and promote well-being.

Furthermore, the study supports the strategic focus of both WHO and India's National Health Policy on competency-based medical education and the integration of simulation-based learning to build practical, team-based, and context-relevant skills in clinical care for better patient outcomes.

Based on these insights, a blended instructional model that integrates the strengths of both RCDP and SCE is recommended for future implementation. Such an approach may offer a more comprehensive and sustainable training strategy for developing high-quality resuscitative competencies.

Acknowledgments

The authors acknowledge the use of the American Heart Association (AHA) Advanced Cardiac Life Support (ACLS) algorithms, which served as the foundational framework for scenario development and performance assessment in this study.

Ethical clearance

As the study did not involve patients or sensitive clinical data and posed minimal risk, formal ethical approval was exempted. Nonetheless, the study adhered to ethical research standards. It followed the guidelines of the Independent Ethics Committee of Symbiosis International University, Pune, India, ensuring the protection and respectful treatment of all participants.

Use of AI tools

OpenAI's ChatGPT and Grammarly were used to for language editing and reference formatting during the preparation of this manuscript. These tools supported clarity, refined grammar, and organized citations. No AI tools were used for data collection, analysis, or interpretation. The authors take full responsibility for the integrity, accuracy, and ethical compliance of the entire manuscript.

Abbreviations

- ACLS – Advanced Cardiac Life Support
- AHA – American Heart Association

- CCF – Chest Compression Fraction
- CPR – Cardiopulmonary Resuscitation
- CVD – Cardiovascular diseases
- RCDP – Rapid Cycle Deliberate Practice
- ROSC – Return of Spontaneous Circulation
- SCE – Simulated Clinical Experience
- WHO – World Health Organization.

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Nil.

Conflicts of interest

There are no conflicts of interest.

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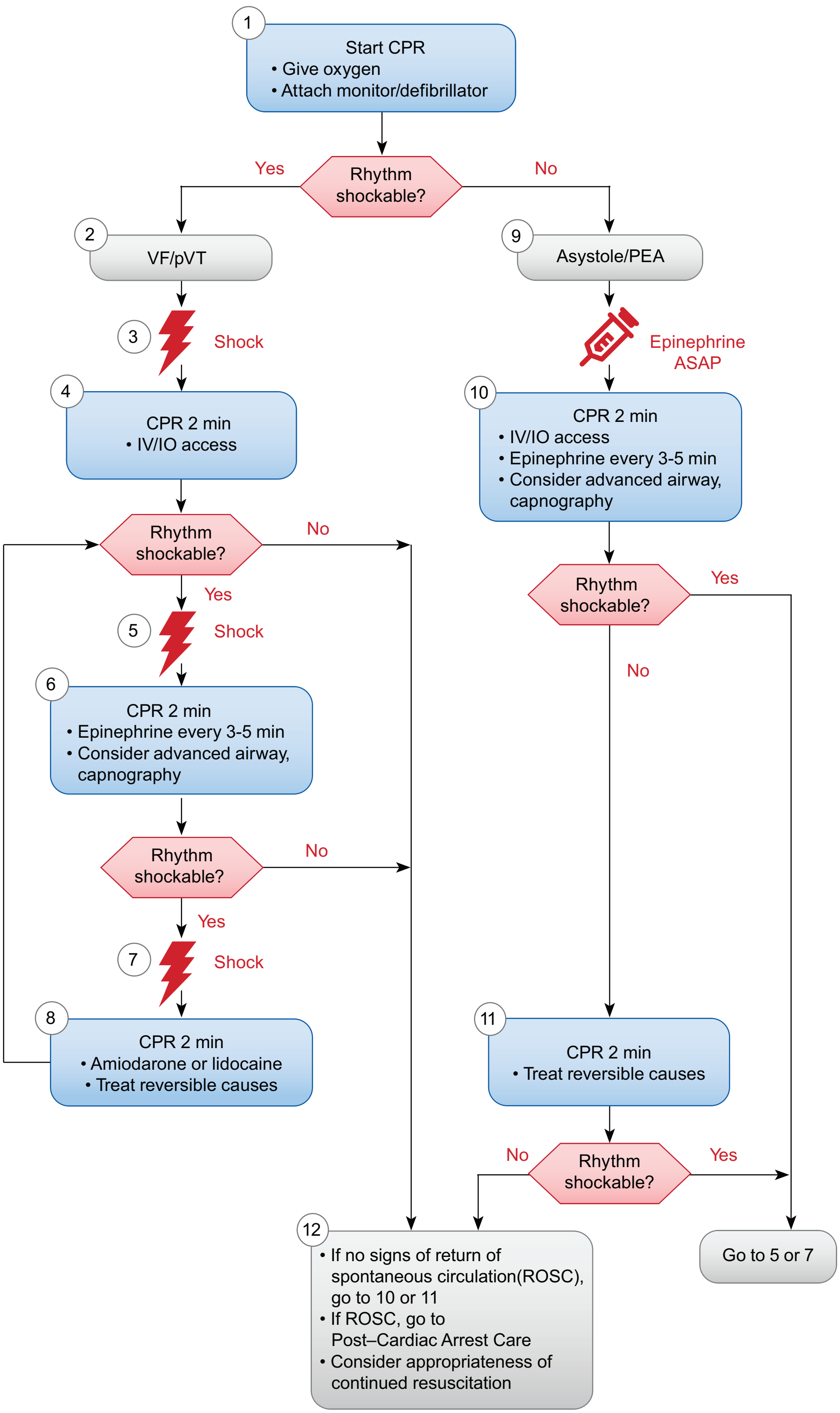
Adult Cardiac Arrest Algorithm



CPR Quality

- Push hard (at least 2 inches [5 cm]) and fast (100-120/min) and allow complete chest recoil.
- Minimize interruptions in compressions
- Avoid excessive ventilation
- Change compressor every 2 minutes, or sooner if fatigued
- If no advanced airway, 30:2 compression-ventilation ratio
- Quantitative waveform capnography
– If $Petco_2$ is low or decreasing, reassess CPR quality

Shock Energy for Defibrillation

- Biphasic: Manufacturer recommendation (eg, initial dose of 120-200 J); if unknown, use maximum available. Second and subsequent doses should be equivalent, and higher doses may be considered.
- Monophasic: 360 J

Drug Therapy

- Epinephrine IV/IO dose: 1 mg every 3-5 minutes
- Amiodarone IV/IO dose: First dose: 300 mg bolus. Second dose: 150 mg. *or* Lidocaine IV/IO dose: First dose: 1-1.5 mg/kg. Second dose: 0.5-0.75 mg/kg.

Advanced Airway

- Endotracheal intubation or supraglottic advanced airway
- Waveform capnography or capnometry to confirm and monitorET tube placement
- Once advanced airway in place, give 1 breath every 6 seconds (10 breaths/min) with continuous chest compressions

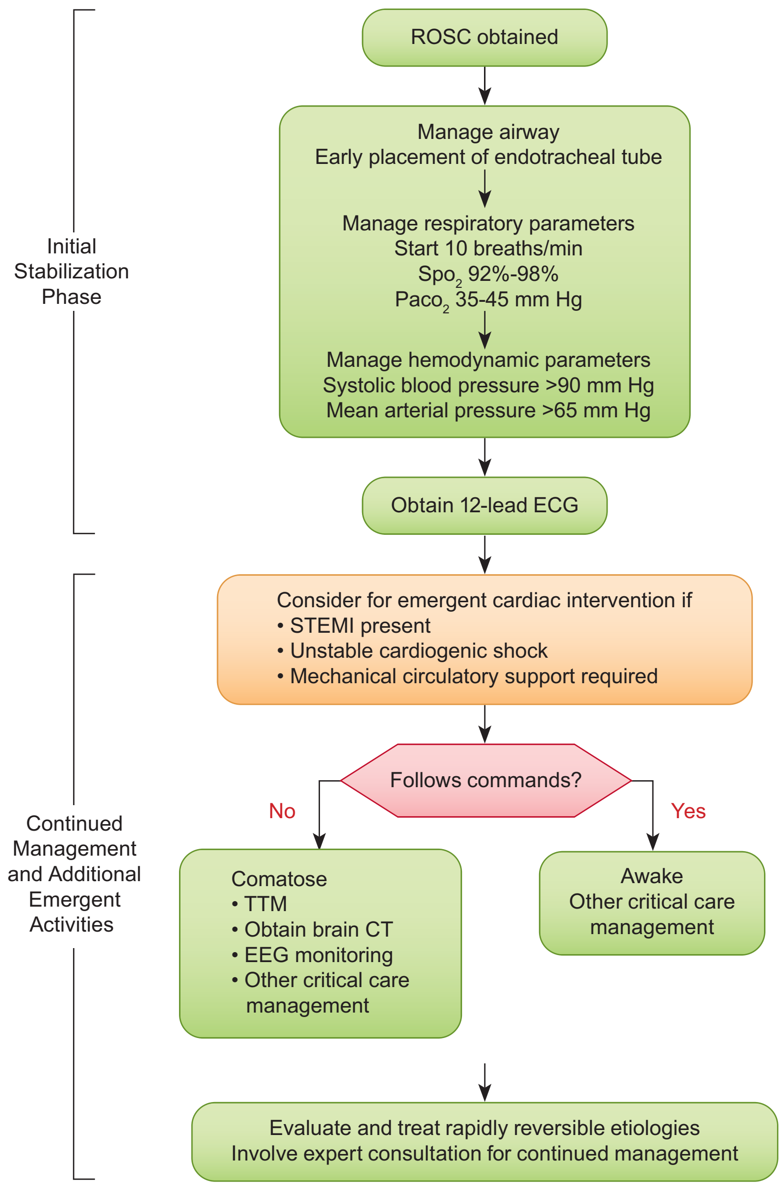
Return of Spontaneous Circulation (ROSC)

- Pulse and blood pressure
- Abrupt sustained increase in $Petco_2$ (typically ≥40 mm Hg)
- Spontaneous arterial pressurewaves with intra-arterial monitoring

Reversible Causes

- Hypovolemia
- Hypoxia
- Hydrogen ion (acidosis)
- Hypo-/hyperkalemia
- Hypothermia
- Tension pneumothorax
- Tamponade, cardiac
- Toxins
- Thrombosis, pulmonary
- Thrombosis, coronary

ACLS Healthcare Provider
Post–Cardiac Arrest Care Algorithm



Initial Stabilization Phase

Resuscitation is ongoing during the post-ROSC phase, and many of these activities can occur concurrently. However, if prioritization is necessary, follow these steps:

- Airway management: Waveform capnography or capnometry to confirm and monitor endotracheal tube placement
- Manage respiratory parameters: Titrate Fio_2 for Spo_2 92%-98%; start at 10 breaths/min; titrate to Paco2 of 35-45 mm Hg
- Manage hemodynamic parameters: Administer crystalloid and/or vasopressor or inotrope for goal systolic blood pressure >90 mm Hg or mean arterial pressure >65 mm Hg

Continued Management and Additional Emergent Activities

These evaluations should be done concurrently so that decisions on targeted temperature management (TTM) receive high priority as cardiac interventions.

- Emergent cardiac intervention: Early evaluation of 12-lead electrocardiogram (ECG); consider hemodynamics for decision on cardiac intervention
- TTM: If patient is not following commands, start TTM as soon as possible; begin at 32-36°C for 24 hours by using a cooling device with feedback loop
- Other critical care management
  - Continuously monitor core temperature (esophageal, rectal, bladder)
  - Maintain normoxia, normocapnia, euglycemia
  - Provide continuous or intermittent electroencephalogram (EEG) monitoring
  - Provide lung-protective ventilation

H's and T's

Hypovolemia
Hypoxia
Hydrogen ion (acidosis)
Hypokalemia/hyperkalemia
Hypothermia
Tension pneumothorax
Tamponade, cardiac
Toxins
Thrombosis, pulmonary
Thrombosis, coronary