

A critical evaluation of a study focusing on a preferred cardiopulmonary resuscitation technique in infants

Abstract

Motivation/problem statement: This paper critically evaluates a study that discusses the preferred infant cardiopulmonary resuscitation technique. Confusion regarding infant cardiopulmonary resuscitation techniques is a common phenomenon that can result in life-threatening situations. Cardiopulmonary resuscitation techniques today are based on evidence gleaned from different studies and guidelines; however, few studies have discussed the superiority of one technique to another. Therefore, the aim of this paper is to identify the most effective cardiopulmonary resuscitation technique for infants.

Approach/method: Research databases were searched for a study regarding cardiopulmonary resuscitation techniques in infants. The search was limited to randomised control studies published in English within the last ten years, conducted on humans. A framework devised by Ingham-Broomfield¹ was used to critically analyse and review the article.

Results: After critically appraising a study by Huynh et al.² the result was that the TT technique using a raised table should be the preferred technique to teach infant CPR to individuals. Additionally, the two-thumb (TT) technique is preferable for infants less than one year old; however, if the rescuer (s) cannot physically encircle the victim's chest, then the two-finger (TF) technique would be more appropriate to achieve effective chest compressions.

Conclusion: In conclusion, it is difficult to ascertain the best method for infant cardiopulmonary resuscitation and there is a need for more studies to investigate the best infant cardiopulmonary resuscitation technique. Future studies will help to improve current practice and will add to the evidence base of practice.

Keywords: cardiopulmonary resuscitation, infant, two-thumb

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Abbreviations: AHA, American Heart Association; AAP, American Association of Pediatrics; CPR, cardiopulmonary resuscitation; HPC, health professions council; RCT, randomised control trials; RCN, royal college of nursing; TT, two-thumb technique; TF, two-finger technique

Introduction

In cardiac arrests in infants, there is artificial respiration, which is provided via cardiopulmonary resuscitation (CPR) for simulated life support. In such situations, there is an imminent danger to the infant's life; therefore, the American Heart Association (AHA) recommends that bystanders and others carry out infant CPR.³ Using the two-finger technique (TF) to teach infant CPR to laypersons is recommended by the AHA.

This assignment aims to determine the superiority of one of the two methods of infant CPR over the other. The selected article queries the contradictory recommendations made by the AHA and the American Association of Pediatrics (AAP), which is to emphasise the reliability of the two-thumb (TT) over the TF technique. This is interesting to the author, as confusion regarding this issue is commonplace in clinical practice.

Search strategy

The Scopus, Pubmed and Ovid Medline databases, among Cardiff University's subject resources for operating department practitioners,

were searched to find an appropriate article. The keywords used to search the databases were: CPR, infant and two-thumb. The limitations on the search were: articles published between 2005 and 2013 so as to get information on up-to-date evidence-based practice, articles in English as translation takes more time than was available, clinical trial as they are the gold standard when conducted appropriately and humans for ethical consideration see Appendix. The article by Huynh et al.² was chosen as it was that which conformed most closely to the rationale and aim of this study. This article was evaluated using a critique framework devised by Ingham-Broomfield.¹

Article critique

The selected study was carried out by Huynh et al.² to assess CPR in infants using the TT and TF techniques on various surfaces. The aim of the study is clearly presented in the introduction and the authors identify a gap in the literature in regard to infant CPR techniques that motivated them to conduct their research. No justification for the chosen research method appears in the paper, although this could have increased the rigour and validity of the study.⁴ The study's hypothesis is that the TT technique is better and more effective than TF on all surfaces.

The research methodology describes how a researcher undertakes to investigate and explain a research query systemically.⁴ In this research, a randomised crossover design was used to guide the study. It is a study design in which participants are subjected to diverse treatments and randomised into different groups, but all groups

receive the same treatment to compare the influence of intervention.⁵ This allows a determination of the effect of each of treatment on each subject.⁶ This methodology was considered a good fit for the study purpose, which was to compare the effects of TT and TF techniques and provide appropriate infant CPR on different surfaces.⁷ To reduce the risk of intervention bias, participants were randomised into two different groups, which reduced bias because randomly allocating is an equivalent process to flip a coin to either one intervention. To maintain participant blindness, they were not informed about their performance during the procedure; this is important to reduce one source of bias in research, as participants often tend to alter their behaviour in a particular way if they are told about certain aspects of the study.⁵

Twenty participants were recruited for the study, including various neonatal practitioners already trained in providing infant CPR. The method used for their recruitment was, however, not explained and no inclusion or exclusion criteria mentioned is mentioned.⁷ The generalizability of this study's results is questionable as all participants were trained staff.⁸ Further, there is also no sample size analysis or pilot study discussed in the paper, although these are considered important to increase validity (ref). That said, participants were included in the study only after obtaining informed consent; thereby satisfying the ethical requirements for conducting such research.⁹ The data collection method is explained well, including the type of manikin used for the research and since a pilot study was not conducted, it is assumed that the validity and reliability of the data collection tool were also not checked to reduce a possible source of bias.^{10,11}

Finally, the statistical processes for data analysis are a student *t* test and ANOVA, which are beneficial to determine the difference between three or more groups that are unrelated,¹² whilst the discussion section identifies the limitations and merits of the study in a clear manner. Accordingly, it can be concluded that the article is comprehensible and readable with the results presented in a Table. The abbreviations used in the literature are also described in a complete and helpful way to make them more comprehensible to a layperson.

Main findings

The study results indicate that compression depth using the TT method is favourable, on the floor (TT=27±8mm vs TF=23±7mm), table (26±7mm for TT vs 22±7 for TF); while in a radiant warmer situation (TT is 29±4 vs TF is 23±4). Moreover, decay in compression was also higher with the TF technique than with the technique TT on the floor and in a warmer situation compared to on a table. Participants also favoured a table to a radiant warmer or floor because it was considered less tiring and more appropriate. Therefore, the authors conclude that the TT technique is more appropriate for teaching infant CPR as it achieves greater compression depth, has less decay over time, and better predictability.³

Evaluation of findings and implications for practice

The study recommends using the TT technique for infant resuscitation, as it is easier to perform, and causes less finger fatigue compared to TF. Using TT also results in increased blood flow from the heart to the rest of the body by increasing systolic blood pressure, and therefore produces a higher coronary perfusion pressure leading to increased sternal compression force.³ Based on evidence from recent studies, the AHA now includes the TT technique as an effective alternative approach to TF.¹³ In addition, various clinical studies have been conducted that have concluded that the TT technique is considered easier and more effective for chest compressions, because it results in lateral compression with sternal compression by squeezing the chest, whereas TF only results in sternal compression.^{14–17}

This study suggests that compressions are more effective with the TT technique on all surfaces, regardless of the number of rescuers. Nevertheless, some practitioners suggest that TT is a more effective approach when performed by more than one rescuer.¹⁷ Therefore, with robust evidence from recent studies, the focus of training can be shifted to techniques that are more productive for infant CPR. It follows, therefore, that the TT technique is preferable if the victim is an infant of less than one year old.¹⁸ If however, the rescuer(s) cannot physically encircle the victim's chest, then the TF technique would be more appropriate to achieve effective chest compressions.¹⁹

Most providers are not specialists in delivering infant CPR, as cardiopulmonary arrest is much less common in infants than in adults.¹⁶ Therefore, it is essential to provide refresher sessions to retrain staff in infant CPR since they do not practise it as often as they do adult CPR. Woollard et al.²⁰ conducted a randomised control trial study with 75 participants to determine the appropriate timing for refresher training in CPR skills in general and recommend that refresher training should be given no more than seven months after primary training. Therefore, since adult CPR needs refresher training within seven months, infant CPR skills would need a smaller gap between primary training and refresher training.

Starting infant resuscitation immediately, with appropriate education, proves to be beneficial in improving the infant mortality rate.¹⁵ Staff should, therefore, be confident, expert, and well trained in performing CPR with a focus on the TT technique and understand the differences between infant and adult CPR. Indeed, this is an essential consideration, because if CPR is not administered correctly it may not only be useless for the patient but even damaging.³ In addition, maternity and paediatric department staff must be well trained because of their daily exposure to infant and paediatric patients,²¹ and achievement of this could be achieved by running training workshops and practice evaluations every month. Moreover, preparations in all departments, with the necessary tools of various sizes for infant resuscitation, are important to reduce any delay or interruption in delivering intervention.²²

Infants may also suffer cardiopulmonary arrest at home, which can be a particularly harrowing experience with only their parents in attendance. Therefore, providing sessions to train parents or other laypersons to act as rescuers and initiate resuscitation would be beneficial, as this would decrease the mortality rate of infants due to delayed CPR intervention.²³ Training sessions could be initiated in antenatal clinics or as a post-natal discharge requirement.^{21,24}

Efficient team dynamics is another important factor, as the resuscitation process requires an effective team approach from various hospital departments.²⁵ This can be achieved by establishing a code for a CPR emergency understood by all departments in a hospital setting, as team members require smooth and unimpeded communication for effective basic life support. Joint Commission²⁶ statistics indicate that, in 47 cases, 72% of infant mortality is the result of a lack of appropriate communication between team members and the organisational culture. In maintaining the traditional hierarchy and failure to deliver CPR effectively as a team form a barrier to effective communication.²⁷ Therefore, team dynamics require an appropriate leadership style, besides smooth and effective communication, in order to improve operational performance and identify weaknesses in resuscitation delivery through guiding and overseeing the rest of the team.²⁸ An equal simulation technique is also advised for training in rescuer team dynamics in order to achieve excellence in resuscitation outcomes.²⁹

Ethical and Legal Issues

Healthcare professionals must be trained and competent according to the Standards of Conduct, Performance and Ethics (SCPE) of the Health Professions Council.³⁰ while performing any intervention required to ensure patient safety. In most circumstances, ethically, patient consent has to be obtained for any medical intervention or treatment, but in the case of resuscitation the situation is different because time is of the essence and intervention without consent is considered lawful to save a patient's life.³¹ Resuscitation decisions, however, become more complex if an infant is very premature or has some genetic anomaly, as this involves concerns regarding the age of viability.³² Resuscitation is often withheld in such situations as it can either prolong the dying process or be considered futile for survival. Therefore, rescuers and providers should also be taught about the ethical and legal issues involved.³³ Moreover, the resuscitation team leader is the one who will decide when to stop the resuscitation process and this must be expressed to the parents with sensitivity.

Beauchamp³⁴ states that there are four basic ethical principles to guarantee the patient's right to make health decisions: beneficence, non-maleficence, autonomy and justice. A patient's best interest is ensured by beneficence. Thus, beneficence dictates that rescuers must be trained in and certified to initiate CPR. Non-maleficence obliges the provider to avoid harm while caring for the patient. Hence, it is recommended that CPR skills be taught appropriately and reviewed by mentors or teachers to ensure the delivery of safe and effective patient care.³³ From an autonomy perspective, patients have the right to make their own decisions about their health and treatment, and justice requires that providers make decisions regardless of the religion, race or ethnicity of the patient.^{11,35} In the case of infants, rights in treatment are entrusted to their parents or care providers who must make decisions in their best interest. If, however, parents refuse appropriate and effective treatment for reasons of religion or beliefs, the doctor has to make a decision in the best interest of the patient and should request legal advice. Hence, detailed documentation is vital to explain the reasons underlying his/her decision.³⁶ Moreover, healthcare providers are required to weigh the risks and benefits while delivering life-sustaining treatment to infants, so that harm is avoided.⁹

Conclusion

To conclude, the TT technique using a raised table should be the preferred technique to teach infant CPR to individuals. Therefore, it is hoped that applying the suggested implications and avoiding any legal complaints will improve healthcare practice and infant mortality will be reduced.

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Conflicts of interest

The authors declare that there is no conflict of interests regarding the publication of this paper.

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