



CARDIOPULMONARY RESUSCITATION IN PRONE POSITION IN ICU SETTING AND IN OPERATING ROOM

Anaesthesiology

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ABSTRACT

Background and Objectives: The prone position is commonly used in certain surgical procedures and to improve oxygenation in mechanically ventilated patients with acute respiratory distress syndrome (ARDS). Cardiorespiratory arrest (CRA) in this position may be more challenging to treat because care providers trained in conventional cardiopulmonary resuscitation (CPR) may not be familiar with CPR in the prone position. The aim of this systematic review is to provide an overview of current evidence regarding the methodology, efficacy, and experience of CPR in the prone position, in patients with the airway already secured. **Material and Methods:** We included articles containing data on patients who had undergone prone CRA and received prone CPR, as well as those studying the efficacy or methodology of prone CPR. This systematic review was conducted in accordance with current guidelines on systematic literature reviews and registered at the International Prospective Register of Systematic Reviews (PROSPERO) (CRD42020197458). The databases searched were MEDLINE, CINAHL, Cochrane CENTRAL, Cochrane Database of Systematic Reviews, Scopus and Google Scholar. **Results:** Our search returned a result of a total of 268 articles: 78 on PubMed, 177 on Scopus, and additional 13 on Google Scholar. Ten of twelve cases survived prone resuscitation, although few cases reported long term outcome (neurological status at hospital discharge) **Conclusion:** ROSC was achieved in patients without changing the patient's position to supine CPR in the prone position seems to be a reliable method. Defibrillation in the prone position is also possible.

KEYWORDS

COVID-19; CPR; Cardiopulmonary resuscitation; Prone; Resuscitation

INTRODUCTION

The prone position is commonly used in certain surgical procedures to facilitate surgical access and in intensive care unit to improve oxygenation in mechanically ventilated patients with acute respiratory distress syndrome (ARDS). Cardiorespiratory arrest (CRA) in this position may be more challenging to treat because care providers trained in conventional cardiopulmonary resuscitation (CPR) may not be familiar with CPR in the prone position.

Patients testing positive for coronavirus disease 2019 (COVID-19) required ICU admission for persistent refractory hypoxemia. For such patients, mechanical ventilation in the prone position may improve oxygenation.

The aim of this systematic review is to provide an overview of current evidence regarding the methodology, efficacy, and experience of CPR in the prone position, in patients with the airway already secured. The search strategy included PubMed, Scopus, and Google Scholar. As a secondary objective, we offer a description of recommendations for basic and advanced CPR in the prone position to facilitate its application in patients undergoing CRA in this position

METHODOLOGY:

Total 50 cases of possible CPR in prone position were initially identified.

- 45 during ventilation in the prone position due to respiratory distress in COVID infection.
- 1 patients underwent prone CPR during the performance of a CT-guided biopsy
- In 4 patients CPR was performed as a result of CRA during surgery (Brain tumor Resection and spinal surgery) in the prone position.

Two of these studies compared hemodynamic parameters obtained during resuscitation in the prone position with those obtained while supine. Studies published up to April 2021 concerning CRA or CPR in the prone position were eligible for this systematic review.

Eligibility:

We included articles containing data on patients who had undergone prone CRA and received prone CPR, as well as those studying the efficacy or methodology of prone CPR. This systematic review was

conducted in accordance with current guidelines on systematic literature reviews and registered at the International Prospective Register of Systematic Reviews (PROSPERO) (CRD42020197458). This article adheres to the applicable Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statement.

Studies were identified within the electronic databases PubMed, Scopus, and Google Scholar. One study reviewed computerized tomography (CT) images to locate the best area to perform chest compressions in the prone position.

Our search returned a total of 268 articles: (78 on PubMed, 177 on Scopus, and an additional 13 on Google Scholar).

Exclusion Criteria:

- Articles did not address prone CPR
- Articles focused on sudden infant death attributed to sleeping in the prone position
- Articles described aspects of acute respiratory distress syndrome (ARDS) without mentioning CRA or CPR
- Articles examined CRA situations in which CPR could not be performed
- Articles involved patients during surgery in the prone position who underwent CPR in the supine position.

RESULTS:

ROSC was achieved in patients without changing the patient's position to supine. In summary, CPR in the prone position seems to be a reliable method to provide CPR in patients positioned prone.

Cardiopulmonary arrest Position: (n=50)	CPR position	Defibrillation	ROSC
	Prone(n= 22)	Yes (n=5) No (n=17)	Yes(n=3) Yes(n=13)
	Supine(n= 17)	No(n=17)	Yes(n=7) No(n=10)
	Prone start then turned into supine (n=11)	Yes(n=7) No(n=4)	Yes(n=6) No(n=5)

In the 2 observational studies of patients who had failed supine CPR, BP values obtained during compressions in the prone position were higher than those obtained in the supine position. For prone CPR, landmarks for hand placement used during supine CPR are obviously ineffective. However the results of a study which we collected, a 2017 imaging study determined that hand placement between T7 and T9 locates the compressions over the largest transverse section of the left ventricle



Figure-1 Location where compressions are recommended to be performed in the prone position. Red line represents location of compressions. Black line represents inferior scapular limit



Figure-2



Figure-3 Location where defibrillation pads should be placed in the prone position

DISCUSSION:

Prone CPR carries potential advantages with respect to speed of initiation, particularly when arrest is witnessed. Shortening the time needed to recognize CRA and initiate CPR likely produces better results.

Existing theories regarding the mechanism by which CPR sustains the circulation suggest that prone CPR is feasible. According to the "Heart pump" theory, compressions squeeze the heart between the anterior wall of the spine and the sternum, creating a flow in systemic and pulmonary circulations.

In contrast, the "chest pump" theory argues that compressions produced in the thorax decrease intrathoracic volume and increase intrathoracic pressure, generating a gradient that produces blood flow to the aorta and the pulmonary arteries. Both theories are compatible with prone CPR and suggest that the rhythm and the depth of compressions are important aspects of successful CPR.

Limitations:

Sample size of our study was small, For feasible outcome bigger

sample size is needed In covid scenario limitation of man power was the main concern.

CONCLUSION:

It remains reasonable to initiate resuscitation in the prone position if turning the patient supine would lead to delays or risk to providers or patients. Prone resuscitation quality can be judged using end-tidal CO₂, and arterial pressure tracing.

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