A Decent Way of Mouth to Mouth Resuscitation with Our Hands (A Technique Suitable for Resuscitation of Out of Hospital Cardiac Arrest Situations), Comparison with Bag and Mask Ventilation-A Clinical Study in Anesthetized and Paralyzed Patients in Operation Room

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ABSTRACT

AIM

Early recognition of cardiac arrest, Early high quality CPR with effective external cardiac compression, early defibrillation and early transportation to nearest medical center saves many avoidable deaths at home or any other public gathering [1,2]. A lot of public awareness, knowledge and training has to be given to all the citizens regarding importance of early recognition of cardiac arrest and rescue measures, as delay in resuscitation beyond 4 minutes is likely to result in serious damage to brain functions even after full recovery from cardiac arrest.

MATERIALS AND METHODS

As the sufficient data of out of hospital cardiac arrests for the publication was difficult to get as they were very rarely reported, we selected 50 ASA grade 1 and 2 anesthetized and paralyzed patients with normal circulation and other vital functions coming for elective surgeries who also needed ventilator support before endotracheal intubation. 25 patients we ventilated with Bain's anesthesia circuit and Connell's face mask with 50% oxygen and Air, and 25 patients with Oxygen enriched expired air of anesthesiologists.

RESULTS

Oxygen saturation maintained 100% in all the patients, and we did not come across any adverse effects in any of our patients during anesthesia time or in the post-operative period.

CONCLUSION

We recommend this decent way of mouth to mouth resuscitation as a part of CPR in selected and safe group of patients without transmissible infectious diseases with cardiac arrest or respiratory arrest needing respiratory support outside the hospital if no other means of respiratory support are readily available.

KEYWORDS: Out-of-hospital cardiac arrest, Mouth to mouth resuscitation, Bag and mask ventilation, COVID-19.

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INTRODUCTION

Early resuscitation is possible only for by stander who observes the person collapsing. Mouth to mouth respiratory support is a second vital part of resuscitation along with external cardiac compression as first priority and early defibrillation by

an AED. So many apprehensions and objections will be there for giving mouth to mouth respiratory support to the unknown cardiac arrest victim [3-6]. In this article we wish to demonstrate a decent technique of mouth to mouth resuscitation. Sudden cardiac arrest is a leading cause of death throughout the World. Out-of-Hospital Cardiac Arrest (OHCA) accounts for about 350,000 annual adults deaths in the USA [7]. Out of the patients who survive with ROSC after OHCA, rate of survival to hospital discharge and survival with good neurological outcome remains less than 10%. There is significant variation in OHCA survival to discharge rate (3.4%-22%) and survival with functional recovery (0.8%-21%) across the US [8]. Neurological and Cardiac causes dominate as causes of out of hospital cardiac arrests in western statistics, apart from trauma. In India also, after trauma and road traffic accidents, the following are the causes of out of hospital cardiac arrests in India shown in (Table 1) [9-12].

Presumed cardiac arrest aetiology	Number	Percentage
Presumed cardiac	814	88%
Poisoning	52	6%
Respiratory	15	2%
Electrocution	10	1%
Snakebite	10	1%
Others	25	2.72%
Total	926	100.00%

Table 1: Causes of Out of Hospital Cardiac Arrests in India.

Patient loses consciousness in 10 seconds after cessation of cerebral circulation due to sudden cardiac arrest. If the resuscitation is delayed for more than 4 minutes there will be some deficits in brain function even if the patient regains consciousness after cardiopulmonary resuscitation. Early recognition of cardiac arrest, early high quality CPR, effective chest compression to maintain some cerebral circulation, (A and B) maintenance of clear air way and respiratory support, and early defibrillation with AED or manual defibrillator can save many out of hospital cardiac arrest victims [13-15].

For the Respiratory Support Outside Hospital

- Mouth to mouth respiration
- Mouth to mask ventilation
- Ambu bag assisted ventilation
- Supraglottic air way devices assisted respiration
- Ventilation by endotracheal intubation,
- Front of neck airway assisted ventilation, are the available choices [16-19].

Problems with Respiratory Support

- Inflation of stomach, reflux and aspiration of gastric contents.
- Rise of intrathoracic pressure, reducing venous return to heart and reducing cardiac output.
- Cardiac compression has to be interrupted for respiratory support if only one resuscitator is there.

Risk of throat and other respiratory infections to the resuscitator (like COVID 19) [20-23]. In adult cardiac arrests because of Ventricular Fibrillation, Oxygen tension in blood would start falling after 4-5 minutes of starting of external cardiac compression, hence ventilator support becomes mandatory only after 4-5 minutes after starting external cardiac compression .Till that time effective uninterrupted external cardiac compression itself can maintain some air exchanges in the lungs., Ventilator support by mouth to mouth respiration or by Ambu bag has equal number of disadvantages and advantages:

- Aspiration of gastric contents.
- Rise of intra thoracic pressure impeding venous return and cardiac output-reducing cerebral perfusion.
- If only one resuscitator is there, cardiac compression has to be interrupted for ventilation and external cardiac compression is more vital for cerebral and coronary perfusion. However, in pediatric age group respiratory support has to be started simultaneously as most common cause for cardiac arrests in children is hypoxia [24-27].

MATERIALS AND METHODS

Ventilator support is an important act in the resuscitation of out of hospital or in the hospital cardiac arrest. To have data from out of hospital cardiac arrest registry alone it takes long time (some years), and another difficulty is reporting of out of hospital cardiac arrests is not carried out in our country due to various reasons. We decided to check the efficiency of our technique of mouth to mouth resuscitation in American Society of Anesthesiologists (ASA) 1 and 2 patients with normal circulation coming for elective surgical procedures who needed respiratory support after induction of anesthesia and before endotracheal intubation. Now after this COVID 19 epidemic, everybody is apprehensive about their safety while giving mouth to mouth resuscitation in an unknown victim. Our purpose in writing this article is to demonstrate our decent technique of mouth to mouth ventilator support using our hands, as one more new technique of respiratory support which is very useful in out of hospital cardiac arrests.

Our data was from 2017 and 2018(before COVID 19 epidemic), and we did not find time to write a paper after collecting data. We selected 50 healthy ASA 1 and 2 patients coming for elective surgical procedures to KIMS, Amalapuram in the years 2017 and 2018, who were willing for our study. We took written consent from all of them or from the parents of minor patients. We clearly explained about our study, and we were ready for all alternative measures of ventilation in case of any difficulty. We informed Ethics committee of our hospital of 2017 regarding our study and purpose of our study.

Inclusion Criteria

- Patients willing for our study.
- ASA 1 and 2 patients.
- Healthy and young with no comorbidities without any active upper respiratory infections.
- Patients coming for elective surgical procedures on empty stomach.

Exclusion Criteria

- Patients not willing for our study.

- Patients with comorbidities and ASA 3-5.
- Patients coming for emergency surgeries.
- Patients in extremes of age.
- Patients on full stomach or inadequate fasting time.

We Kept

- Emergency crash cart ready, with all emergency drugs, air ways, laryngoscope, endotracheal tubes (all sizes) and ambu bag, emergency tracheostomy and cricothyroid puncture set.
- Electrical, vacuum and foot suctions (all the three) in working condition.
- Anesthesia machine with Oxygen, Nitrous, oxide and air supply with Bain's anesthesia circuit and closed circuit ready.
- Multichannel monitor with BP, Oxygen saturation, and Electro Cardio Gram (E C G).

We gave sufficient training to all our colleague anesthesiologists and post graduate students in our technique of mouth to mouth ventilation on a mannequin initially and on patients later. We explained them about our study and purpose of our study clearly (to use this technique for respiratory support in out of hospital cardiac arrests and respiratory arrests.)

Our Technique of Ventilator Support

- Ventilating anesthesiologist stands of right side of the patient's head.
- Elevates mandible of the patient keeping his left index finger behind angle of mandible.
- Extends patient's neck to make a clear air way
- Forms a mask pinching nose of the patient with his thumb and index finger of his right hand.
- Presses tightly over patients chin with his right thinner eminence, hence forming air tight mask.
- Keeps his lips over thumb and index finger of his own right hand and blows his expired air into patient's air way. We planned to supplement 6-8 liters of Oxygen with a nasal prongs to the anesthesiologist's nostrils to enrich their inspired as well as expired air with higher percentage of Oxygen.
- We divided patients into 2 groups, 25 patients in group A selected for mouth to mouth ventilation and 25 in group B selected for ventilation by Bain's anesthesia circuit.

Group A patients: As soon as patient was shifted on to OR table we connected monitors taken good IV line, started Ringer's lactate infusion. We then premedicated with Fentanyl 1 Micro grams/kg IV and Midazolam 1 mg IV, and Glycopyrrolate 0.3 mgs IV, 5 minutes before anesthesia. We pre oxygenated patients for full 5 minutes with 100% of oxygen through Bain's circuit. We connected 6-8 liters of oxygen to the anesthetist's nostrils through nasal spectacle, asked him to inhale from his nose and blow air into patient's respiratory tract through his mouth, after induction and 1st dose of non-depolarizing muscle relaxant. Induction of anesthesia was done with Thiopentone 5 mg/kg (or sleep dose) paralyzed by Vecuronium 4-6 mg IV (0.08-0.1 mgms/kg). One anesthetist with nasal prongs ventilated the patient with his expired air, and another anesthesiologist monitored the patients till full paralysis established. We made sure to see the visible chest rise with ventilator support, and avoided air entering into stomach. Then the patient was intubated with required endotracheal tube, and previously planned general anesthesia for the required surgical procedure was started. We introduced nasogastric tube in all our patients after endotracheal intubation to check whether air had entered stomach. Opening of mouth of the patient and elevating angle of mandible with our left index finger shown in (Figure 1). Forming a mask tightly pressing on mandible with right thinner eminence-producing air tight fitting shown in (Figure 2).

Group B patients: As soon as patient was shifted on to OR table we connected monitors taken good IV line, started Ringer's lactate infusion. We then Premedicated with Fentanyl 1 micro gms/kg IV and Midazolam 1 mg IV, and Glycopyrrolate 0.3 mgs IV, 5 minutes before anesthesia. We pre oxygenated patients for full 5 minutes with 100% of oxygen through Bain's circuit. Induction of anesthesia was done with Thiopentone 5 mg/kg (or sleep dose) paralyzed by Vecuronium 4-6 mg IV (0.08-0.1) mgms/kg. One anesthetist was ventilating the patient with Bain's anesthesia circuit with 50% oxygen+air till full paralysis was achieved while another anesthesiologist was carefully monitoring the vital parameters. We made sure to see the visible chest rise with ventilation and avoided air entering into stomach. Then the patient was intubated with required endotracheal tube and previously planned general anesthesia for the required surgical procedure was started. We introduced nasogastric tube to check whether air had entered stomach in this group of patients also. Blowing our expired air keeping our mouth on our right thumb and index finger-to achieve visible chest rise shown in (Figure 3).

We made sure see that patient maintained normal vital functions throughout the anesthesia and surgical time and seen the recovery score also at the end of surgical procedure. We monitored both groups of patients for 24 hours in the post-operative recovery room shown in (Table 2).

SER NO	AGES	NO OF PATIENTS
1	1-10 YEARS	NIL
2	10-20 YEARS	12
3	20-30 YEARS	27
4	30-40 YEARS	7
5	40-50 YEARS	4

Table 2: Ages and No of Patient's.

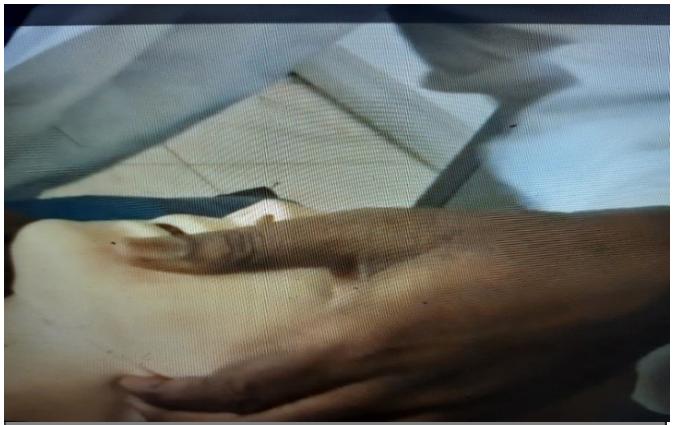

Figure 1. Opening of Mouth of the Patient and Elevating Angle of Mandible With our Left Index Finger.

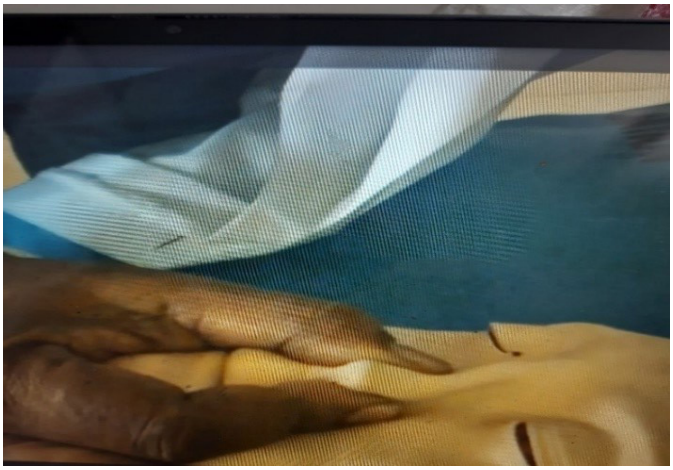

Figure 2: Forming a Mask Tightly Pressing on Mandible With Right Thinner Eminence-Producing Air Tight Fitting.

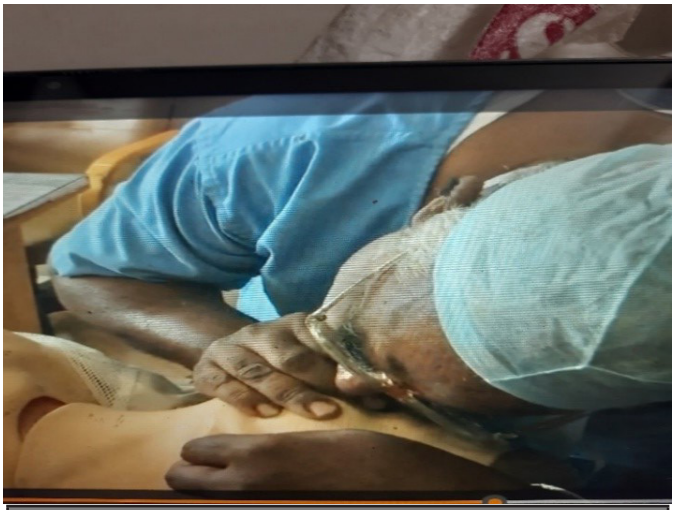

Figure 3: Blowing Our Expired Air Keeping Our Mouth on Our Right Thumb and Index Finger-to Achieve Visible Chest Rise.

RESULTS and DISCUSSION

Both group of patient's induction of anesthesia, ventilation till intubation time, endotracheal intubation time and maintenance of anesthesia were uneventful and smooth. Vital functions maintained normal throughout anesthesia time. Recovery from anesthesia and post-operative period were uneventful.

No patient developed inflation of stomach during both types of ventilations. No patient developed reflux of gastric secretions and aspiration into lungs.

No patient developed any other post-operative and post anesthesia complications in 24 hours after surgery.

History of mouth to mouth resuscitation

- Mouth to mouth resuscitation technique is in practice since Biblical days-there was a mentioning of mouth to mouth resuscitation in stories of Elijah and Elisha-about saving a patient in suffocation by mouth to mouth resuscitation.
- Sir Peter Safar's prone position respiratory support and Holger and Neilsen method–were the techniques in the starting days of mechanical support to respiration.
- In 1953, total number of articles published in literature describing respiratory support were 105.
- 1950, Sir peter Safar described respiratory obstruction caused by tongue falling back in unconscious patients, and described techniques of chin lift and jaw thrust to solve this problem.
- ABC (Air way, Breathing and Circulation) were chain of survival described by American Heart Association in 2000. All the patients of cardiac arrest develop apnea hence respiratory support was considered as a 1st priority till 2000. Later since 2005, CAB sequence was adopted as chain of survival for cardiac arrest victims during resuscitation. Before 2000, 5 external cardiac compressions and 1 respiration was advised by AHA as one cycle. In 2005 and later AHA had modified their technique-30 chest compressions and 2 respirations was suggested as one cycle [28-39].

In adults cardiac arrest most of the times shall be fibrillary arrest hence priority for respiratory support was questioned in the later years as there were reports of Oxygen tension in blood not falling till below 93% and PC02 was not rising above 40% in patients who are apneic till 4-5 minutes after fibrillary cardiac arrest. If the External cardiac compression was started early some amount of air movement from atmosphere shall be there and blood gas levels may not change up to 10 minutes [38,39].

Disadvantages of Ventilator Support

- If only one resuscitator is there–external cardiac compression has to be interrupted for giving respiratory support. External cardiac compression and administration of Adrenaline are very vital for cerebral and coronary perfusion.
- Distal esophageal sphincter will lose its tone in cardiac arrest patients reflux regurgitation, and aspiration of gastric juice causes deterioration of lung function which is vital for maintaining oxygen saturation in blood.
- Raised intra thoracic pressure causes increase of intrathoracic pressure causing reduced venous return to of blood to heart-resulting in reduced cardiac our put.
- Time spent on ventilator support sacrifices valuable chest compression time.
- Fear of transmission of respiratory diseases to the resuscitator (Bacterial like PTB, Viral diseases like, Hepatitis, AIDS, and COVID 19) [40-43].

Limitations of ventilator support in cardiac arrest resuscitation

- In fibrillary Cardiac-Eternal cardiac compression, early defibrillation, and Administration of Adrenaline in time are more vital for maintaining cerebral circulation and coronary perfusion than ventilator support for initial 5 minutes. Later if the PO2 decreases, and PCO2 rises Ventilator support becomes mandatory. Part of resuscitation.
- In children and New born babies, Respiratory support is vital as most of the cardiac arrests in children occurs be-

cause of hypoxia.

- In cardiac arrest due to asphyxia or drowning, Respiratory support becomes mandatory part of cardiopulmonary resuscitation [44-48].

Cerebral Recovery after out of hospital cardiac arrests

Cerebral Performance Categories score (CPC score) Neurological recovery is taken as guide for recovery scoring after Return of Spontaneous Circulation (ROSC) [49-56].

Grade 1: good recovery without any disabilities.

Grade 2: Mild to moderate disability.

Grade 3: severe disability.

Grade 4: Vegetative state.

Grade 5: Death.

Favorable response after out of hospital cardiac arrest resuscitation depends on

- Age of the victim.
- Comorbidities.
- Shockable or non-shockable rhythm.
- No flow time and low flow time.
- CPR time.
- Amount of Adrenaline given.
- Availability of AED and other resuscitative equipment and drugs.
- Area where victim gets cardiac arrest.
- PO2, PCO2 and Ph of blood.
- Availability of trained personnel in CPR.
- Early recognition of cardiac arrest.
- Early high quality CPR.

After achieving ROSC

- Early coronary angiography and Coronary revascularization.
- Proper Ventilator support in ICU.
- Intra-aortic Balloon, or any other mechanical support to circulation.
- Timely ECMO.
- In time targeted temperature. Decide further fate of the out of hospital cardiac arrest victim who is successfully shifted to a tertiary care hospital soon after getting ROSC [57].

CONCLUSION

Our aim in reporting this technique is to show that resuscitator can use this technique in ideal situations like respiratory arrest due to drowning, cardiac arrest in children, and neonatal resuscitation. After this COVID 19 epidemic resuscitators must be more careful and selective in using this technique on unknown victims of cardiac arrest outside hospital. We wanted to show that we can give ventilator support without keeping our lips over victim's mouth and lips.

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