Clinical question.

For non-intubated bradycardic neonates (P) requiring positive pressure ventilation, is the CO2 monitoring device (I) more effective than chest rise, color (C) for assessing adequate ventilation (O)?

Is this question addressing an intervention/therapy, prognosis or diagnosis?  
Intervention

State if this is a proposed new topic or revision of existing worksheet: New topic

Conflict of interest specific to this question

Do any of the authors listed above have conflict of interest disclosures relevant to this worksheet?

No

Search strategy (including electronic databases searched).

PubMed/MEDLINE


EMBASE

Search 1 'newborn'/exp OR newborn AND intermittent AND positive AND (‘pressure'/exp OR pressure) AND (‘ventilation'/exp OR ventilation) AND (‘carbon'/exp OR carbon) AND (‘dioxide'/exp OR dioxide)

Search 2. ‘newborn'/exp OR newborn AND (‘resuscitation'/exp OR resuscitation) AND (‘carbon'/exp OR carbon) AND (‘dioxide'/exp OR dioxide)

The Cochrane Central Register of Controlled Trials (CENTRAL)


State inclusion and exclusion criteria

Inclusion – studies of the use of exhaled carbon dioxide detectors in human infants receiving positive pressure ventilation at birth by face mask, nasal airways or laryngeal mask

Exclusion – studies of animal models, studies of intubated human infants

Number of articles/sources meeting criteria for further review:

PubMed/MEDLINE

1 from 26 identified


EMBASE

Search 1 – 0 of 68 studies identified

Search 2 – 1 of 205 studies identified


The Cochrane Central Register of Controlled Trials (CENTRAL)

1 from 1 identified

# Summary of evidence

## Evidence Supporting Clinical Question

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**Level of evidence**

A = Return of spontaneous circulation  
B = Survival of event  
C = Survival to hospital discharge  
D = Intact neurological survival  
E = Other endpoint  
*Italics = Animal studies*
### Evidence Neutral to Clinical question

<table>
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<th>Level of evidence</th>
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<th>Finer 2009 B⁶</th>
<th>Leone 2006 B⁵</th>
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**Level of evidence**

- A = Return of spontaneous circulation
- C = Survival to hospital discharge
- E = Other endpoint
- B = Survival of event
- D = Intact neurological survival

**Italics = Animal studies**

### Evidence Opposing Clinical Question

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**Level of evidence**

- A = Return of spontaneous circulation
- C = Survival to hospital discharge
- E = Other endpoint
- B = Survival of event
- D = Intact neurological survival

**Italics = Animal studies**
**REVIEWER’S FINAL COMMENTS AND ASSESSMENT OF BENEFIT / RISK:**

| Colourimetric exhaled (or end-tidal) carbon dioxide (CO₂) detectors (ETCO₂) change colour in the presence of exhaled CO₂. Though these detectors were designed for use in intubated patients, their use in adults receiving respiratory support through face masks, laryngeal mask airways and oesophageal tube airways has been described and is thought to be of use in detecting the return of pulmonary circulation in adults with cardiorespiratory arrest. ¹ Manufacturers of paediatric ETCO₂ detectors recommend that they be used only in infants and children weighing 1 – 15kg who are intubated.² Their use has been studied in intubated newborns³ and have been recommended by ILCOR for confirming correct placement of endotracheal tubes in newborns.⁴ One group has described the use of ETCO₂ detectors placed between the ventilation device and face mask during mask ventilation of a series of infants before endotracheal intubation in the neonatal intensive care unit (n=23)⁵ and, subsequently, during mask ventilation of a series of infants in the delivery room (n=18).⁶

Finer et al reviewed video recordings they made in the delivery room of 18 infants < 32 weeks’ gestation who were enrolled in a randomised trial of different oxygen concentrations during delivery room resuscitation.⁶ Though they did not specifically state whether the infants who received PPV in the delivery room were bradycardic, the authors report that none received chest compressions or epinephrine and all were judged to have an effective circulation. The authors report the absence of colour change in the detector for a variable amount of time during mask PPV in all 18 infants. Colour change was achieved by measures taken by the attending clinicians, most often repositioning of the infants head. Thirteen of the 18 infants were intubated in the delivery room. The authors concluded that airway obstruction, as identified by lack of colour change in an ETCO₂ detector placed between the ventilation device and mask, is common during mask ventilation of newborn infants in the delivery room.

Comparisons with clinical assessments of adequacy of ventilation (assessing chest rise and colour) were not made. No risks attributable to the use of ETCO₂ detectors were reported.

**Acknowledgements:**

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**Citation List**


Comments: This study demonstrates that ETCO₂ detectors may show colour changes during positive pressure ventilation through interfaces other than endotracheal tubes. However, this study is of adults, presumably with aerated lungs, who have circulatory arrest. As newborns have fluid-filled (non-aerated) lungs and circulatory arrest is rare, its applicability in delivery room resuscitation of newborns in uncertain.

Level of evidence: 5

Quality: Fair

2. PediCap ® Directions for Use. Nellcor, Tyco Heathcare Group LP, Nellcor Puritan Bennett Division, Pleasanton, CA USA


4. The International Liaison Committee on Resuscitation. The International Liaison Committee on Resuscitation (ILCOR) consensus on science with treatment recommendations on pediatric and neonatal patients. *Pediatrics* 2006; 117: 978-988

Colorimetric carbon dioxide detectors are useful indicators of proper endotracheal tube placement. We have found that they also are helpful during bag and mask ventilation as an indicator of a patent airway. In this report, we describe our experience with these devices for use during preintubation airway stabilization as observed during videotaped performances from a prospective, randomized trial of intubation premedication.

Comment: This study describes the results of a review of high-quality video recordings of the use if ETCO₂ detectors during mask ventilation of newborn infants in the neonatal intensive care unit taken during a randomised controlled trial of premedication for endotracheal intubation. It suggests that detectors may of use in detecting airway obstruction during mask ventilation. The relevance to use in the delivery room is unclear as these infants were sedated and/or given muscle relaxants, and presumably already had aerated lungs.
Level of evidence: 5
Quality: Good


Comment: This study reports a review of the use of ETCO₂ detectors during mask ventilation of 18 infants using high-quality video recordings taken during a randomised controlled trial. It suggests that detectors may help identify airway obstruction.
Level of evidence: 4
Quality: Good