<table>
<thead>
<tr>
<th>WORKSHEET for Evidence-Based Review of Science for Emergency Cardiac Care</th>
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<td>Worksheet author(s)</td>
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<td>Robert Bingham</td>
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Clinical question.

In pediatric patients in cardiac arrest (prehospital [OHCA] or in-hospital [IHCA]) (P), does the use of supraglottic airway devices (I) compared with bag-valve-mask alone (C), improve therapeutic endpoints (eg, ventilation and oxygenation), improve quality of resuscitation (eg, reduce hands-off time, allow for continuous compressions), reduce morbidity or risk of complications (eg, aspiration) or improve survival (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: Revision of existing worksheet: Note; the previous one was confined to LMA only. Other supraglottic devices have been introduced since the 2005 evidence evaluation

Conflict of interest specific to this question

Do any of the authors listed above have conflict of interest disclosures relevant to this worksheet?
Potential intellectual conflicts: Editor of ERC paediatric guidelines. Co-editor of ERC EPLS and EPILS manual

Search strategy (including electronic databases searched).

In Medline & Cochrane, AHA ENL and Embase: “Supraglottic airway OR laryngeal mask airway OR LMA AND Resuscitation OR Cardiopulmonary Resuscitation OR CPR”. Limited to last 5 years and “Child or Adolescent”

This proved to be a sensitive but not specific search. The resulting 782 hits were hand searched and relevant articles selected.

- State inclusion and exclusion criteria
  Inclusion: Peer reviewed publications
  Exclusion: Papers in press, abstracts, review articles. Papers related to resuscitation at birth

- Number of articles/sources meeting criteria for further review:
  67 articles were considered, none of which directly evaluated the use of supra-glottic devices in children requiring resuscitation. 23 articles were selected for inclusion in the evidence evaluation.
## Summary of evidence

### Evidence Supporting Clinical Question

<table>
<thead>
<tr>
<th>Level of Evidence</th>
<th>Good</th>
<th>Fair</th>
<th>Poor (Authors)</th>
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</thead>
<tbody>
<tr>
<td>A</td>
<td>1</td>
<td>2</td>
<td>Stone 1994 E</td>
</tr>
<tr>
<td>B</td>
<td>3</td>
<td>4</td>
<td>Carenzi 2002 E</td>
</tr>
<tr>
<td>C</td>
<td>5</td>
<td>6</td>
<td>Fraser 1999 E</td>
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<tr>
<td>D</td>
<td></td>
<td></td>
<td>Gursoy 1996 E</td>
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<td>E</td>
<td></td>
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<td>Iohom 2002 E</td>
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<td></td>
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<td>Johr 2003 E</td>
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<td>Leal-Pavey 2004 E</td>
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<td>Russell 2008 E</td>
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<td></td>
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<td>Scheller 2009 E</td>
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<td></td>
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<td>Selby 1997 E</td>
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<td></td>
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<td>Stocks 2002 E</td>
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<td>Yao 2004 E</td>
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</tbody>
</table>

**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

| Good | | | | | | Blevin 2009 E  
| Rechner 2007 E  
| SOS-KANTO 2009 E |
| Fair | | | | | | Chen 2008 E  
| Lopez-Gill 1996a E |
| Poor | | | | | | |
| 1 | 2 | 3 | 4 | 5 | |

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 Opposing Clinical Question

| Good | | | | | | Bagshaw 2005 E  
| Flick 2008 E  
| Guyette 2007 E  
| Harnett 2000 E  
| Lopez-Gill 1996b E  
| Park 2001 E |
| Fair | | | | | | |
| Poor | | | | | | |
| 1 | 2 | 3 | 4 | 5 | |

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
Numerous case reports (LOE5) (Carenzi 2002, Fraser 1999, Iohom 2002, Johr 2003, Russell 2008, Scheller 2009, Stocks 2002, Yao 2004) document the successful use of supraglottic airway devices (SADs) in the management of airway emergencies by experienced providers, particularly in children with supraglottic airway abnormalities. One case report demonstrated the successful use of a LMA by an inexperienced provider in this circumstance (Leal-Pavey 2004). In addition, the laryngeal mask airway (LMA) has been used successfully for resuscitation at birth (Grein 2005) and evidence from adult literature (LOE 5) demonstrates that suitably trained, non-expert, providers can deliver effective positive pressure ventilation in cardiac arrests using LMAs (Stone 1994) although this has not been shown to result in improvement in blood gas results compared to bag/mask ventilation (BMV) (SOS-KANTO study group 2009). There are however, no studies comparing SADs with bag-mask ventilation (BMV) in paediatric resuscitation.

Evidence obtained from the use of SADs (particularly the LMA) during anaesthesia in children (LOE5), suggests that although positive pressure ventilation is safe and feasible (Gursoy 1996, Selby 1997) complications are more common than in adults, particularly for small children and infants (LOE 5) (Lopez-Gill 1996a, Park 2001, Bagshaw 2002, Hartnett 2000, Flick 2008) and that complications diminish with operator experience (Lopez-Gill 1996a, Lopez-Gill 1996b).

A manikin study (LOE5) that compared ventilation using an LMA to that with tracheal intubation in a cardiac arrest model, found that effective ventilation was achieved more rapidly and complications were lower in the LMA group (Chen 2008). A similar study (LOE5) comparing the LMA to BMV showed that, although effective ventilation was achieved in all subjects, time to effective ventilation was shorter and tidal volumes were greater in the BMV group (Guyette 2007).

Two well-designed studies by the same group in anaesthetised children (LOE5) compared ventilation through the LMA to BMV delivered by intensive care nurses (Rechner 2007) and ward nurses (Blevin 2009). Although the success rates were similar for both techniques, time to delivery of 1st breath was significantly shorter in the BMV group. In the more recent study there were a small subset of children in whom ventilation was not possible by BMV but achieved with a LMA. The authors suggest that LMA insertion could be taught to first responders as a rescue technique if BMV was unsuccessful.

There are a number of other supra-glottic airway devices available in paediatric sizes (Cobra PLA, Laryngeal tube, iGel). Although these have been used successfully during anaesthesia, there are no studies examining their potential role in paediatric resuscitation.

Acknowledgements:

Citation List


LOE 5. Fair. Opposing
Observational study of the size 1.5 LMA demonstrating higher incidence of complications in children between 5 & 10kg


LOE 5. Good. Neutral
A study from the same goup as Rechner 2007 comparing use of LMA vs mask/airway by ward nurses in anaesthetised children. Although use of the bag/mask system resulted in more rapid achievement of adequate chest rise, there were a small number of children in whom the study volunteer was unable to achieve any ventilation by this means but was successful through the LMA. The authors suggest that LMA insertion should be taught as a second line airway management technique.

Study included as reference only, not included in table
LOE 2. Neutral
PRCT comparing laryngeal tube and LMA in anaesthetised children showing the LMA to be superior. Possible confounding factor was that the investigators had greater experience with the LMA.


LOE 5. Poor. Supportive
Case report


LOE 5. Fair. Neutral
Mannikin study comparing paramedic tracheal intubation with LMA, demonstrating time to effective ventilation was shorter with LMA and complications fewer.


LOE 5. Fair. Opposing
Observational study showing use of LMA is an independant risk factor for laryngospasm during anaesthesia in children


LOE 5. Poor. Supportive
3 case reports of use of LMA for emergency airway management


Study included as reference only, not included in table
LOE 4. Neutral
Observational paper showing the laryngeal tube is a viable device during anaesthesia


Study included as reference only, not included in table
LOE 1. Supporting
Cochrane review of one small study!! Only addressed resuscitation at birth and therefore not relevant to the PICO question but was supportive of the use of LMA when other methods had failed.

LOE 5. Good. Neutral
Large adult PRCT comparing LMA with bag/mask airway management demonstrating that LMA use doesn't result in improved gas exchange although it may facilitate continuous chest compressions.


LOE 5. Supporting
Observational study of positive pressure ventilation of children with LMA demonstrating feasibility of the technique and little gastric distension


LOE 5. Fair. Opposing
Mannikin study demonstrating that ventilation using an LMA feasible in a paediatric respiratory arrest scenario. Time to first ventilation and tidal volumes were significantly worse in the LMA group.


LOE 5. Fair. Opposing
PRCT demonstrating high incidence of complications in infants managed with LMA as opposed to facemask.


LOE 5. Poor. Supportive
Case report


LOE 5. Poor. Supportive
Case report


LOE 5. Poor. Supportive
Case report of successful LMA use by inexperienced operator


Study included as reference only, not included in table

LOE 3. Neutral
Initial investigation of the proseal LMA in children under anaesthesia

LOE 5. Fair. Neutral
Very large survey of complication rates with LMA in infants and children showing relatively high incidence of minor problems (11.5%) but no major morbidity. The complication rate diminished with increasing operator experience


LOE 5. Fair. Opposing
Well conducted study showing that problems with LMA insertion are high with inexperience and diminish to very low levels over the course of 75 insertions


LOE 5. Fair. Opposing
Prospective study demonstrating higher incidence of complications with the use of LMA with decreasing age


Study included as reference only, not included in table
LOE 4. Neutral
Observational study of the use of a new supraglottic airway (Cobra PLA) in anaesthetised children.


LOE 5. Good. Neutral.
Good quality study, simulating respiratory arrest in anaesthetised children, comparing the delivery of successful rescue breaths by intensive care nurses using facemask or LMA. There was no significant difference in success rates between the 2 groups, although time to 1st breath was significantly longer in the LMA group.


Study included as reference only, not included in table
LOE 4. Neutral
Study of the laryngeal tube in anaesthetised children, identifying an increased complication rate in those <10kg and a learning curve which resulted in a reduction in complications after the 1st 5 insertions.


LOE 5. Poor. Supporting
Case report of successful use of LMA in airway abnormality.


LOE 5. Poor. Supporting
Case series describing use of laryngeal tube (suction) in 10 neonates and infants in whom conventional techniques had failed.


LOE 5. Supportive
PRCT demonstrating safety of positive pressure ventilation through an LMA in anaesthetised children


LOE 5. Poor. Supportive
Case report


LOE 5. Fair. Supportive
Adult study supporting use of LMA by first responders


Study included as reference only, not included in table
LOE 5. Supporting
Prospective, randomised mannikin simulation of CPR demonstrating reduced 'no flow' time when laryngeal tube used as opposed to LMA.


LOE 5. Poor. Supportive
Case report


Study included as reference only, not included in table - Review article