

WORKSHEET for PROPOSED Evidence-Based GUIDELINE RECOMMENDATIONS

Worksheet Author:	Home Subcommittee: NRP
Author's Home Resuscitation Council: Sociedad Argentina de Pediatria	Date Submitted to Subcommittee: Nov 1, 2004; revised Dec 4, 2004

STEP 1: STATE THE PROPOSAL. State if this is a proposed new guideline; revision to current guideline; or deletion of current guideline.

Existing guideline, practice or training activity:

Existing guideline:

Initial Ventilation Strategies:

Bag-Valve-Mask Ventilation: Types of Bags

Resuscitation bags should be no larger than 750 mL; they can either be self-inflating or require a compressed gas source to inflate (flow-inflating).

The former require attachment of an oxygen reservoir to permit delivery of high oxygen concentrations. Those who advocate longer inflation times recommend a minimum bag volume of 500 mL so that inflation pressure can be maintained for at least 1 second. If the device contains a pressure-release valve, it should release at approximately 30 cm H₂O pressure and should have an override feature to permit delivery of higher pressures if necessary to achieve good chest expansion. (ILCOR 2000 Pediatrics 1999;103(4) e56)

NRP TEXTBOOK- AAP-AHA 2000 “ You will learn that watching for chest movement is the most important sign of effective positive-pressure ventilation; if you watch for this important sign, bag-and-mask ventilation can be provided quite effectively with **either type of bag.**”

Bags used for newborns should have a volume of 200 to 750 mL.

To minimize complications resulting from high ventilation pressures, resuscitation bags should have certain safety features to prevent unwanted high pressures. These features will be different for each type of bag.

Step 1A: Refine the question; state the question as a positive (or negative) hypothesis. State proposed guideline recommendation as a specific, positive hypothesis. Use single sentence if possible. Include type of patients; setting (in-/out-of-hospital); specific interventions (dose, route); specific outcomes (ROSC vs. hospital discharge).

- Self-inflating bags, flow-inflating bags or mechanical devices designed to regulate pressure as needed and connected to a mask that is attached to a t-piece *are adequate to resuscitate newborn babies*”
- If a self-inflating bag is used, a minimal volume of 450ml is required.

Step 1B: Gather the Evidence; define your search strategy. Describe search results; describe best sources for evidence.

Searched using following textwords: Bag AND Mask, Resuscitation, newborn, lung rupture, device, ventilation
List electronic databases searched (at least MEDLINE (<http://igm.nlm.nih.gov/>) and hand searches of journals, review articles, and books.

Medline, Review Articles, Embase and Cochrane database.

- State major criteria you used to limit your search; state inclusion or exclusion criteria (e.g., only human studies with control group? no animal studies? N subjects > minimal number? type of methodology? peer-reviewed manuscripts only? no abstract-only studies?)

No abstract-only studies

- Number of articles/sources meeting criteria for further review: Create a citation marker for each study (use the author initials and date or Arabic numeral, e.g., “Cummins-1”). If possible, please supply file of best references; End Note 4+ preferred as reference manager, though other reference databases acceptable.

715 hits, after a quick review 135 articles remained for detailed screening. 117 were excluded (out of focus), 18 were analyzed and 11 are included in the evidence grid.

STEP 2: ASSESS THE QUALITY OF EACH STUDY

Step 2A: Determine the Level of Evidence. For each article/source from step 1, assign a level of evidence—based on study design and methodology.

Level of Evidence	Definitions (See manuscript for full details)
Level 1	Randomized clinical trials or meta-analyses of multiple clinical trials with substantial treatment effects
Level 2	Randomized clinical trials with smaller or less significant treatment effects
Level 3	<u>Prospective</u> , controlled, non-randomized, cohort studies Massawe A, et al. (1996)
Level 4	<u>Historic</u> , non-randomized, cohort or case-control studies Hoskyns E, et al. (1987); Allwood AC et al. (2003)
Level 5	<u>Case series</u> : patients compiled in serial fashion, lacking a control group Cole A, (1979) Kanter R. (1987)
Level 6	Animal studies or mechanical model studies Rosen M, et al. (1981); Field D, et al. (1986); Tendrup T, et al. (1989) Milner A, et al. (1992); Gnaga Zandzou PS, et al. (1996); Finer N, et al. (2001)
Level 7	Extrapolations from existing data collected for other purposes, theoretical analyses
Level 8	Rational conjecture (common sense); common practices accepted before evidence-based guidelines

Step 2B: Critically assess each article/source in terms of research design and methods.

Was the study well executed? Suggested criteria appear in the table below. Assess design and methods and provide an overall rating. Ratings apply within each Level; a Level 1 study can be excellent or poor as a clinical trial, just as a Level 6 study could be excellent or poor as an animal study. Where applicable, please use a superscripted code (shown below) to categorize the primary endpoint of each study. For more detailed explanations please see attached assessment form.

Component of Study and Rating	Excellent	Good	Fair	Poor	Unsatisfactory
Design & Methods	Highly appropriate sample or model, randomized, proper controls AND Outstanding accuracy, precision, and data collection in its class	Highly appropriate sample or model, randomized, proper controls OR Outstanding accuracy, precision, and data collection in its class	Adequate, design, but possibly biased OR Adequate under the circumstances	Small or clearly biased population or model Weakly defensible in its class, limited data or measures	Anecdotal, no controls, off target end-points Not defensible in its class, insufficient data or measures

A = Return of spontaneous circulation C = Survival to hospital discharge E = Other endpoint

B = Survival of event D = Intact neurological survival

Step 2C: Determine the direction of the results and the statistics: supportive? neutral? opposed?

DIRECTION of study by results & statistics:	SUPPORT the proposal	NEUTRAL	OPPOSE the proposal
Results	Outcome of proposed guideline superior, to a clinically important degree, to current approaches	Outcome of proposed guideline no different from current approach	Outcome of proposed guideline inferior to current approach

Step 2D: Cross-tabulate assessed studies by a) level, b) quality and c) direction (ie, supporting or neutral/ opposing); **combine and summarize.** Exclude the *Poor* and *Unsatisfactory* studies. Sort the *Excellent*, *Good*, and *Fair* quality studies by both *Level and Quality of evidence*, and *Direction of support* in the summary grids below. Use citation marker (e.g. author/ date/source). In the *Neutral* or *Opposing* grid use bold font for *Opposing* studies to distinguish them from merely neutral studies. Where applicable, please use a superscripted code (shown below) to categorize the primary endpoint of each study.

Supporting Evidence

- a. Self-inflating bags, flow-inflating bags or mechanical devices designed to regulate pressure as needed and connected to a mask that is attached to a t-piece *are adequate to resuscitate newborn babies"*
 b. If a self-inflating bag is used, a minimal volume of 450ml is required.

Quality of Evidence	Excellent							
					Allwood AC et al. (2003) ^{a E}			
	Good				Hoskyns E, et al. (1987) ^{a E}			Rosen M, et al. (1981) ^{a E} Tendrup T, et al. (1989) ^{a E}
Fair			Massawe A, et al. (1996) ^{a E}		Cole A, (1979) ^{a E}	Kanter R. (1987) ^{a E} Milner A, et al. (1992) ^{a E} Finer N, et al. (2001) ^{a E} Field D, et al.		

						(1986)a-b ^E			
		1	2	3	4	5	6	7	8
Level of Evidence									

A = Return of spontaneous circulation C = Survival to hospital discharge E = Other endpoint
 B = Survival of event D = Intact neurological survival (a or b = respective hypothesis)

Neutral or Opposing Evidence

- a. Self-inflating bags, flow-inflating bags or mechanical devices designed to regulate pressure as needed and connected to a mask that is attached to a t-piece *are adequate to resuscitate newborn babies"*
 b. If a self-inflating bag is used, a minimal volume of 450ml is required.

Quality of Evidence	Excellent									
	Good									
	Fair						Ganga Zandzou PS, et al. (1996)a ^E			
			1	2	3	4	5	6	7	8
Level of Evidence										

A = Return of spontaneous circulation C = Survival to hospital discharge E = Other endpoint
 B = Survival of event D = Intact neurological survival (a or b = respective hypothesis)

REVIEWER’S PERSPECTIVE AND POTENTIAL CONFLICTS OF INTEREST: Briefly summarize your professional background, clinical specialty, research training, AHA experience, or other relevant personal background that define your perspective on the guideline proposal. List any potential conflicts of interest involving consulting, compensation, or equity positions related to drugs, devices, or entities impacted by the guideline proposal. Disclose any research funding from involved companies or interest groups. State any relevant philosophical, religious, or cultural beliefs or longstanding disagreements with an

individual.

Mid career Neonatologist, Coordinator of the NRP program in Argentina since 1994. Member, Sub-board of Neonatology, Pediatric Argentinean Society. Chief of Neonatology and Director of University of Buenos Aires fellowship training program at a Large Public Hospital, University of Buenos Aires.

No conflicts of interest.

REVIEWER'S FINAL COMMENTS AND ASSESSMENT OF BENEFIT / RISK: Summarize your final evidence integration and the rationale for the class of recommendation. Describe any mismatches between the evidence and your final Class of Recommendation. "Mismatches" refer to selection of a class of recommendation that is heavily influenced by other factors than just the evidence. For example, the evidence is strong, but implementation is difficult or expensive; evidence weak, but future definitive evidence is unlikely to be obtained. Comment on contribution of animal or mechanical model studies to your final recommendation. Are results within animal studies homogeneous? Are animal results consistent with results from human studies? What is the frequency of adverse events? What is the possibility of harm? Describe any value or utility judgments you may have made, separate from the evidence. For example, you believe evidence-supported interventions should be limited to in-hospital use because you think proper use is too difficult for pre-hospital providers.

Current recommendations related to artificial ventilation of depressed babies in the delivery room are based on studies with a low level of evidence primarily determined "in vitro" using mannequins. There are no randomized clinical studies that have evaluated the role of artificial ventilation in depressed newborn babies during delivery room resuscitation. Furthermore there are no randomized clinical studies that have evaluated the appropriate device to use during delivery room resuscitation.

The available evidence with limited number of subjects suggests that:

- 1- Bag and Mask devices used in resuscitation of the newborn perform better if they have a volume of at least 450ml (Field D 1986, Terndrup T 1989)
- 2- Healthcare providers using flow-inflating bags need more training to provide the desired pressure compared with using the Neopuff® device (Finer 2001)
- 3- The pop-off valve of self-inflating bags are not very accurate and the pressure limit can be easily over-rided (Ganga-zazndzou 1996)
- 4- Mechanical devices designed to regulate pressure as needed and connected to a mask that is attached to a t-piece seem to be safe devices for use in delivery room neonatal resuscitation (Allwood A 2003, Cole A 1979, Hoskyns E 1987, Rosen M 1981)
- 5- To provide the desired pressure, healthcare providers need more training using flow-inflating bags compared with self-inflating bags (Kanter R 1987)

Preliminary draft/outline/bullet points of Guidelines revision: Include points you think are important for inclusion by the person assigned to write this section. Use extra pages if necessary.

Attachments:

Printed (paper) bibliography; and on diskette using a reference manager. It is recommended that the bibliography be printed in annotated format. This will include the article abstract and any notes you would like to make providing specific comments on the quality, methodology and/or conclusions of the study.

Key figures or tables from evidence-based analysis

Full hard copies of most critical cited papers

Citation List

METHODS OF VENTILATION IN THE DELIVERY ROOM (DEVICES)

Citation Marker	Full Citation*
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<p>Allwood AC et al. (2003)</p>	<p>Allwood AC, Madar RJ, Baumer JH, Readdy L, Wright D. (2003) "Changes in resuscitation practice at birth" <u>Arch Dis Child Fetal Neonatal Ed.</u> 88: F375-9</p> <p>AIM: To investigate secular changes in neonatal resuscitation at birth. METHODS: Single centre observational study of 17 890 infants born between May 1993 and April 1997. T-piece ventilation was introduced in April 1995. OBSERVATIONS: Rates and modes of ventilatory resuscitation, early neonatal encephalopathy, neonatal convulsions, and meconium aspiration syndrome; 1 and 5 min Apgar scores; maternal age and method of delivery; paediatric attendance at delivery and resuscitation. RESULTS: The rate of all forms of ventilatory resuscitation fell during the four year period from 11.0% to 8.9%. The rate of intubation fell from 2.4% to 1.2%. A reduced rate of intubation was seen at all gestations of 30 weeks and above. There was no difference in rates of relevant neonatal problems during the period except for a reduction in neonatal convulsions. The introduction of T-piece ventilation did not contribute to the reduction in intubation in a logistic regression model that included time trend. CONCLUSION: A marked reduction in the rate of intubation was observed, without any reduction in the efficacy of resuscitation. This may reflect improvements and changing emphasis in resuscitation training.</p> <p>Comment: Retrospective analysis of prospective clinical data. Historical control. Excellent quality. Compares bag and mask (period 1) to ventilation using the Neo- puff® (period 2). Even though the rates of early neonatal encephalopathy and meconium aspiration syndrome did not change significantly during the study period, the rate of neonatal convulsions fell by 78%. The reduction in the intubation rate at birth, particularly marked between 30 and 37 weeks' gestation, is not attributed exclusively to the introduction of the T piece.</p> <p><i>LOE 4</i> <i>QOE Excellent</i> <i>Supporting hypothesis a</i></p>
<p>Cole A, (1979)</p>	<p>Cole A, Rolbin M (1979) " An improved ventilation system for delivery –room management of the newborn" <u>Anaesth</u> 51 356-8</p> <p>No abstract available.</p> <p>Comment: This is a description of a T-piece and an underwater manometer. The authors mentioned that this device was used in more than 2000 infants over a period of 8 months. There is no description of the whole population or of the outcomes. No comparison with any other method is provided. They say that there were no complications attributable to the apparatus, but fail to mention what kind of complications might have been expected.</p> <p><i>LOE (Level Of Evidence) 5</i> <i>QOE (Quality Of Evidence) Fair</i> <i>Supporting hypothesis a</i></p>

<p>Field D, et al. (1986)</p>	<p>Field D, Milner A et al. (1986) “ Efficiency of manual resuscitators at birth” <u>Arch Dis Child</u> 61 : 301-3</p> <p>The effectiveness of five neonatal/paediatric manual resuscitators was assessed in a group of babies born by caesarean section.</p> <p>Results showed that devices incorporating a large volume reservoir produced the greatest tidal volume, while those with smaller volume reservoirs could not be considered satisfactory for routine use during neonatal resuscitation.</p> <p>Comment: This study considered only C-Section newborns. The staff involved is not described. The conclusions do not reflect the objectives. This is a description of 45 resuscitations in newborns using long inspiratory times.</p> <p><i>LOE 6</i> <i>QOE Fair</i> Supporting hypothesis a-b</p>
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<p>Finer N, et al. (2001)</p>	<p>Finer N, Rich W et al. (2001) Comparison of methods of bag and mask ventilation for neonatal resuscitation <u>Resuscitation</u> 49 : 299-305</p> <p>BACKGROUND: There are a variety of manual bagging devices used for neonatal resuscitation. To our knowledge, there has been no comparison of the ability of different operators to utilize such devices for the delivery of predetermined inspiratory and end-expiratory pressures. In addition, the use of prolonged inflation may be of benefit for infants who require bag and mask ventilation, and there has been no evaluation of the ability of a variety of operators to reliably deliver such breaths using currently available equipment. METHODS: We utilized a neonatal manikin (Laerdal Armonk, NY) with a functional larynx and lungs, and a clear cushioned mask (Owens-BriGam, Morganton, NC). We studied a latex-free disposable anesthesia type bag (Model 5126 Vital Signs, Totawa, NJ), a Jackson-Rees (JR) type anesthesia bag (Model E191 Anesthesia Associates, San Marcos, CA) fitted with a Norman elbow and a flow-control tail-piece (Dupaco, Oceanside, CA), and the Neopuff (Fisher and Paykel, Auckland, New Zealand), an FDA approved mechanical device that is flow-controlled and pressure-limited, specifically designed to facilitate neonatal resuscitation. The ventilating pressures were continuously recorded throughout the process. We evaluated neonatal nurses, neonatal nurse practitioners, neonatal staff and fellows, pediatric residents and neonatal respiratory therapists. RESULTS: The peak inspiratory pressure (PIP) was significantly different between operators using either anesthesia bag, $P < 0.001$. Similar results were found for positive end-expiratory pressure (PEEP) with a significant difference among the operator groups, $P < 0.001$. All the differences in post hoc analysis were between the therapists and the other groups, $P < 0.05$. Therapists produced significantly higher pressures than the other groups for both PIP and PEEP ($P < 0.001$). The PIP was similar for all groups using the Neopuff device. The PIP and PEEP delivered by the Neopuff differed from the other two devices independent of the operators ($P < 0.05$). On post hoc analysis, there was a significant difference between the disposable anesthesia bag and Neopuff for both PIP and PEEP for the therapists, whereas among the non-therapists, there was a difference in PIP with the JR device producing a greater PIP (26.6 ± 3.8 cmH₂O) compared with the Neopuff and disposable anesthesia bag (24.8 ± 1.1 cmH₂O, 24.8 ± 4.3 cmH₂O). The level of PEEP was significantly different among all three devices for the non-therapists (1.3 ± 1.6 cmH₂O, Disposable; 2.9 ± 1.2 cmH₂O, JR; 4.7 ± 0.5 cmH₂O, Neopuff; $P < 0.05$). Only the therapists were able to consistently deliver PEEP with the anesthesia bags, whereas all operators could generate the target PEEP with the Neopuff ($P < 0.05$). We compared the pressure delivered during the first second to the pressure delivered during the fifth second during prolonged 5-s inflations. The absolute differences between the first and fifth second for the Neopuff versus the anesthesia bags were significantly different with a median of 7.1 cmH₂O for the anesthesia bags compared with 0.2 cmH₂O for the Neopuff, $P < 0.001$, reflecting the difficulty in obtaining and maintaining the target inflation pressures. CONCLUSIONS: Our experience suggests that the Neopuff, a purpose-built neonatal resuscitator ventilator, facilitates the delivery of the desired airway pressures while maximizing the operator's ability to obtain and maintain a patent airway, and facilitates the delivery of prolonged inflations. Further research is required to determine the clinical benefit of end-expiratory pressure and prolonged inflations in neonatal resuscitation.</p> <p>Comment: A prospective, controlled study comparing two different flow-inflating bags with the Neopuff™ device used by different health care workers using mannequins. There is no justification of the sample size provided. Many of the statements are based on beliefs and feelings. No description of how the staff was trained in the use of the</p>
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Neopuff®. The discussion section is akin to a review article which goes beyond the scope of this study.

LOE 6

QOE Fair Supporting hypothesis a

<p>Ganga Zandzou PS, et al. (1996)</p>	<p>Ganga Zandzou PS, Diependaele J, Storme L (1996) “La ventilation a l’ Ambu chez le nouveau-né: une simple question de doigté”(Is optimal Ambu ventilation of the newborn a simple question of finger-touch? <u>Arch Pediatr</u> 3: 1270-2</p> <p>[Article in French] Insufflation pressures were measured during manual ventilation using a neonatal rebreathing bag (Ambu on a manikin). Maximal insufflation pressures were greater than that published or given by the manufacturer, theoretically limited to 30 cm of water at open valve, and that whatever the number of fingers used for the compression of the bag. These results indicate that Ambu ventilation, often mandatory for newborn resuscitation, does not simply rely upon the finger-touch of the operator and that it always has a risk of baro- and/or volutrauma.</p> <p>Comment: This is an observational in vitro experimental study. It is not clear how the authors selected the people who participated, and why there is only one measurement per person. The findings are reason for concern.</p> <p><i>LOE 6</i> <i>QOE Fair Opposing Hypothesis a</i></p>
<p>Hoskyns E,et al. (1987)</p>	<p>Hoskyns E, Milner A, Hopkin I (1987) “A simple method of face mask resuscitation at birth” <u>Arch Dis Child</u> 62: 376-8</p> <p>Twenty two infants were resuscitated at birth using a face mask connected to an oxygen supply from a conventional resuscitator. Intermittent finger occlusion provided the positive pressure within the mask. This method was apparently at least as effective as the best bag and mask systems and was convenient to use.</p> <p>Comment: A prospective in vivo study limited only to cesarean section babies. No strict selection criteria. Most babies cried before the episode of apnea. Controlled with historical data, part of another study.</p> <p><i>LOE 4</i> <i>QOE Good</i> <i>Supporting Hypothesis a</i></p>

<p>Kanter R. (1987)</p>	<p>Kanter R. (1987) “ Evaluation of mask-bag ventilation in resuscitation of infants” <u>AJDC</u> 141:761-3</p> <p>Performance of mask-bag ventilation was evaluated on an infant resuscitation mannequin to resolve uncertainty regarding the proficiency of pediatric resuscitation personnel in this technique and to determine whether the type of resuscitation bag used would affect performance. Performance using a self-inflatable resuscitation bag was generally adequate. Forty-six of 50 operators achieved an adequate minute ventilation, and 48 of 50 operators achieved a mean tidal volume exceeding that of the mask plus simulated physiologic dead space. Wide variation with a tendency to hyperventilate and to use excessive pressures indicate the need for improved standard training methods. Technical difficulties with an anesthesia bag impaired performance, suggesting that only self-inflatable bags should be used for mask-bag ventilation during pediatric resuscitation, unless the staff's proficiency with anesthesia bags is clearly demonstrated.</p> <p>Comment: Combines the evaluation of the performance of staff and devices. It is an “in vitro” study (manninquins). The authors’ main objective was to clarify the proficiency of pediatric resuscitation personnel in mask-bag ventilation. The specific type of self-inflating bag used was not stated. It is not clear that the desired performance outcomes used in this study are still applicable.</p> <p><i>LOE 6</i> <i>QOE Fair</i> <i>Supporting Hypothesis a</i></p>
<p>Milner A, et al. (1992)</p>	<p>Milner A, Stokes G, et al. (1992) “ Laboratory assessment of Laerdal mouth tube mask prototype resuscitation device. <u>Med & Biol Eng & Comput</u> 30 : 117-9</p> <p>No abstract available.</p> <p>Comment: This study evaluates a new device tested on both the standard mannequin and a new substitute for mannequins. It does not compare the new device with the standard device currently in use (bag and mask).</p> <p><i>LOE 6</i> <i>LOE Fair</i> <i>Supporting Hypothesis a</i></p>

<p>Massawe A, et al. (1996)</p>	<p>Massawe A, Kilewo Ch, et al. (1996)“Assessment of mouth to mask ventilation in resuscitation of asphyxic newborn babies . A pilot study “</p> <p><u>Trop Med Int Health</u> 1 :865-873</p> <p>The aim of the study was to compare the effectiveness of mouth-to-mask ventilation (MM) in neonatal asphyxia with bag-and-mask ventilation (BM). A new mouth-to-mask infant resuscitation system was constructed. The study was performed in two university clinics with different resources. The KEM Hospital in Bombay was well equipped and neonatologists took part in all resuscitations; Muhimbili Medical Centre in Dar es Salaam was understaffed and had no physicians available at resuscitation. Therefore, different protocols had to be used. In Bombay, the study period was limited to 5 minutes. If needed, mask ventilation was then replaced by intubation. In Dar es Salaam, MM ventilation was continued for up to 10 minutes, the inspiratory pressure was adjusted to 30 cmH₂O and the ventilation was slow (8-10 breaths/min). In Bombay, 30 babies were allocated to the BM and 24 to the MM groups. In Dar es Salaam 56 were in the BM and 64 in the MM groups. The results for term babies in Bombay and both term and pre-term babies in Dar es Salaam showed no significant differences between the two groups of treatment, as determined by Apgar score > or = 4 at 5 and 10 minutes, number of babies with their first gasp, heart rate > 130 beats/min or pulse oximeter values above 75%, all at 5 minutes. An Apgar score > or = 4 at 5 minutes was achieved in more than 75% of all infants, irrespective of treatment. The rates of early neonatal mortality and neonatal convulsions did not differ between the two methods of resuscitation. In Dar es Salaam, the low respiratory frequency used in both groups was associated with a slow increase in heart rate above 130 beats per min. This result indicates that further studies will be needed before such slow respiratory frequencies are used. We conclude that, if adequate training is provided and the respiratory frequency is kept within the normal range, MM ventilation is an alternative to assisted ventilation when no bag and mask is available. However, further studies are necessary, since this method has proved to be tiring and uncomfortable for the resuscitating health personnel.</p> <p>Comment: Since this study used the Apgar score as the primary study end point, a description of the whole population is needed. Moreover there is neither a sample size calculation, nor an adequate description of the inclusion criteria. The authors compare two different centers with very different approaches. Finally this was not a randomized study; alternating periods were compared.</p> <p><i>LOE 3</i> <i>QOE Fair</i> <i>Supporting Hypothesis a</i></p>
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<p>Rosen M, et al. (1981)</p>	<p>Rosen M, Vaughan R et al. (1981) “ A new approach to artificial expansion and ventilation of the lung in the severely asphyxiated neonate” Br. J. <u>Anaesth</u> 53: 249-254</p> <p>In severe asphyxia, expansion of the newborn lung must precede ventilation by intermittent positive pressure. Inadequate expansion may lead to hypoxia and excessive expansion to rupture of the lung. The only way in which a predetermined pressure can be achieved, and not exceeded in the alveoli, is by applying that pressure at the mouth and waiting until all flow ceases. Applying pressure in this way and increasing it according to a "staircase" pattern, with appropriate steps at suitable intervals, should ensure that the maximum pressure produced in the alveoli is no greater than the minimum necessary for resuscitation in each individual infant. On the basis of published work, ranges of optimum values for the increments and time intervals are suggested. Clinical judgment is still necessary to select from within these ranges, but this "pressure staircase" method should provide a systematic approach to the problem. A suitable apparatus is described.</p> <p>Comment: The authors give a good description of a new device for providing neonatal resuscitation (similar to Neopuff™), and, on the basis of theoretical speculation, they propose an approach in which pressure is raised gradually and in steps. This approach was not evaluated in vivo.</p> <p><i>LOE 6</i> <i>QOE Good</i> <i>Supporting Hypothesis a</i></p>
<p>Terndrup T, et al. (1989)</p>	<p>Terndrup T, Kanter R, et al. (1989) “A comparison of infant Ventilation methods performed by prehospital personnel” <u>Ann Emerg Med.</u> 18 : 607-11</p> <p>By comparing mouth-to-mouth ventilation to other methods, we tested whether there are significant differences among infant mannequin ventilation methods performed by emergency medical technicians-paramedics (EMT-Ps). Fifty-nine participants were evaluated in the performance of six ventilation methods; methods studied were mouth-to-mouth; two mouth-to-mask devices; and infant, pediatric, and adult bag-valve-mask devices. By measuring each breath, the percentage of acceptable ventilations in predetermined ranges, 5 to 25 mL/kg or 10 to 20 mL/kg, was calculated. Methods were compared using repeat measures ANOVA testing. Correlation between ventilation performance and the experience of personnel was expressed as the Pearson correlation coefficient. There were no significant differences in performance between methods, except for inadequate ventilation with the Laerdal Pocket Mask (P less than .05) from poor mask fit. The correlation between years of prehospital experience and the number of resuscitations versus ventilation performance was poor. Single rescuer, EMT-Ps can successfully ventilate an infant mannequin with various size resuscitation bags. The Laerdal Pocket Mask is an ineffective device for infant mannequin ventilation and should not be recommended for infant resuscitation.</p> <p>Comment: Only prehospital personnel with different levels of training were evaluated in this study. The authors compared various methods of bag and mask ventilation in a mannequin. Three different mouth devices and three different sizes of self inflating bags were used.</p> <p><i>LOE 6</i> <i>QOE Good</i> <i>Supporting Hypothesis a</i></p>

REVIEW ARTICLES and CONSENSUS	
Milner AD 1991	Milner AD (1991) Resuscitations of the newborn <u>Arch Dis Child</u> 66 :66-69
Milner AD 1998	Milner AD (1998) “Resuscitation at birth “ <u>Eur J Pediatr</u> 157 : 524-527
Saugstad O (1998)	Saugstad O.D. (1998) Practical aspects of resuscitating asphyxiated newborn infants <u>Eur J Pediatr</u> 157 :S11-S15
Kattwinkel J et al. 1999	Kattwinkel J, Niermeyer S et al. (1999) “ ILCOR Advisory Statement: Resuscitation of the newly born infant” <u>Pediatrics</u> 103 : e 56
Niermeyer S et al. 2000	NiermeyerS, Kattwinkel J et al. (2000) “ Guidelines for Neonatal Resuscitation: An excerpt from the Guidelines 2000 for International Consensus on Science. Contributors and Rerviewers for the Neonatal Resuscitation Guidelines. <u>Pediatrics</u> 106 : e29
Milner A. 2001	Milner A. (2001) “ The importance of ventilation to effective resuscitation in the term and preterm infant. <u>Semin Neonatol</u> 6 : 219-224
O’Donnell C 2003	O’Donnell C. et al. (2003) “ Resuscitation of Premature Infants: What Are We Doing Wrong and Can We Do Better? <u>Biol Neonate</u> 84 : 76-82

*Type the citation marker in the first field and then paste the full citation into the second field. You can copy the full citation from EndNote by selecting the citation, then copying the FORMATTED citation using the short cut, Ctrl-K. After you copy the citation, go back to this document and position the cursor in the field, then paste the citation into the document (use Ctrl-V). For each new citation press Enter to move down to start a new paragraph.