

# Newborn resuscitation beyond the immediate postnatal period

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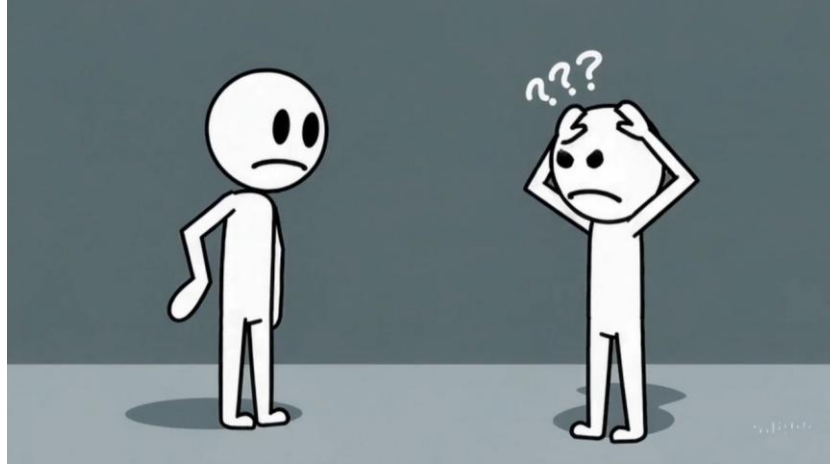
**ANNUAL MEETING  
of the SSN 2025**

**NEWBORN RESUSCITATION**

**TUESDAY, MAY 13, 2025**  
Kultur und Kongresshaus Aarau

# Introduction and objectives

The *postnatal period (WHO)* begins immediately after the birth of the baby and extends up to six weeks (42 days) (some say 8 weeks) after birth



1. What is known in Literature of post-neonatal collapse in the immediate period?
2. Definition / overview / possible precautions
3. Neonatal resuscitation as the connecting topic peripartum and postpartum
4. What`s “new” in CPR or what might be “new”

# Publication metrics and numbers

SUPC

Less than 45 publications in over 50 years

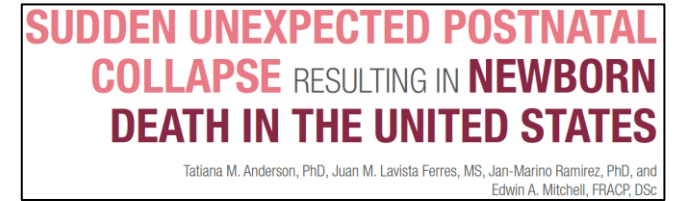
The image shows a screenshot of a PubMed search for the term "SUPC". The search results page displays 45 results. The top result is "Sudden unexpected postnatal collapse." by Monnelly V, Becher JC, published in Early Hum Dev. 2018 Nov;126:28-31. The second result is "Sudden Unexpected Postnatal Collapse: Review and Management" by Ludington-Hoe SM, Addison C, published in Neonatal Netw. 2024 Apr 1;43(2):76-91. The third result is "Sudden Unexpected Postnatal Collapse and Therapeutic Management: A Systematic Review" by Bedetti L, Lugli L, Garetti E, Guidotti I, Roversi MF, Della Casa E, Miselli F, Ferrari F, Berardi A, published in Children (Basel). 2022 Dec 8;9(12):1925.

Below the search results, there is a "RESULTS BY YEAR" bar chart showing the number of publications per year from 1880 to 2025. The chart shows a significant increase in publications starting around 1973, with a peak in 2025.

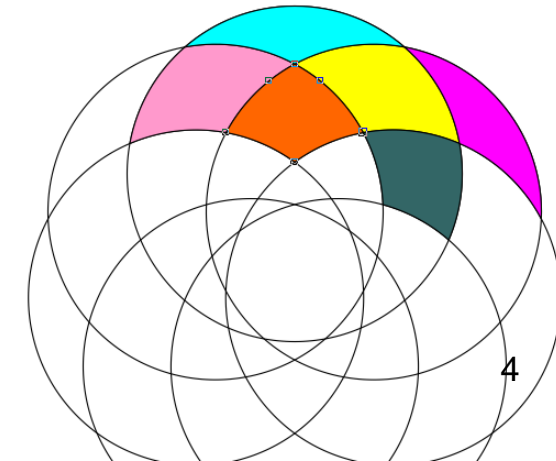
On the left side of the search results, there is a sidebar with filters. The "All (45)" filter is highlighted in red. Other filters include "All Child (19)", "Clinical Prediction Guides/Broad (12)", "Economic clinical trial (0)", "English Diagnosis/Broad (12)", "Economics/Broad (0)", "English & Humans (21)", "Guideline (0)", "Historical Article (0)", "Meta-analysis (0)", "Newborn (18)", "Outcomes Assessment/Broad (15)", "Prognosis/Broad (8)", "Prognosis/Narrow (4)", "published last 5 years (18)", "Review (5)", and "Therapy/Broad (5)".

# Definition?

## It is still not easy and clear



1. SUID (**S**udden **U**nexpected **I**nfant **D**eath) or sleep related deaths (death under 1 year) is a general term comprising SIDS (autopsy negative ICD 10 R95) other deaths (ICD 10 R99) and accidentally suffocation (ICD 10 W75)
2. SUID cases within first week of life (day 0 to 6) are referred to as SUEND (**S**udden **U**nexpected **E**arly **N**eonatal **D**eath)
3. SUPC (**S**udden **U**nexpected **P**ostnatal **C**ollapse) refers to the sudden collapse of a previously healthy term or near-term infant within the first week of life. ( $\geq 35$  wks, normal 5-min Apgar) (Spanning 2 hrs to 7 days)
4. SUEND cases are a subset of SUPC cases. SUPC cases not resulting in death are referred to as ALTE (till 2016) & BRUE cases in the first 6 days and are SUEND if death occurs. BRUE does exist after 6 days as well



# Suggestion to simplify:

SUPC	<b>S</b> udden <b>U</b> nexpected <b>P</b> ostnatal <b>C</b> ollapse
SUEND	<b>S</b> udden <b>U</b> nexpected <b>E</b> arly <b>N</b> eonatal <b>D</b> eath
BRUE	<b>B</b> rief <b>R</b> esolved <b>U</b> nexplained <b>E</b> vents
SUID	<b>S</b> udden <b>U</b> nexpected <b>I</b> nfant <b>D</b> eath
SIDS	<b>S</b> udden <b>I</b> nfant <b>D</b> eath <b>S</b> yndrome

**SUPC and SUEND are BRUE and SUID below 7 days of life**

**SIDS (with unknown death aetiology) is a part of SUID  
(incorporating deaths with known aetiology)**

**SUPC is likely to be more devastating than BRUE**

# SUID & subcategory SIDS

Moon et al., Pediatrics 2022

## Sleep-Related Infant Deaths: Updated 2022 Recommendations for Reducing Infant Deaths in the Sleep Environment

Rachel Y. Moon, MD, FAAP;<sup>a</sup> Rebecca F. Carlin, MD, FAAP;<sup>b</sup> Ivan Hand, MD, FAAP;<sup>c</sup>  
THE TASK FORCE ON SUDDEN INFANT DEATH SYNDROME AND THE COMMITTEE ON FETUS AND NEWBORN

SUID: 35–90/100.000 life births (varies between countries)

### Risk factors:

- prone positioning, smoking in pregnancy, heat exposure
  - Co-sleeping, small for gestational age, prematurity
  - Social factors: socio economic status, young mothers
1. Triple-risk model: vulnerable infant (arousal) + trigger (sleep environment) + critical phase
  2. Recommendations: supine positioning; use of a firm, noninclined sleep surface; room sharing without bed sharing; and avoidance of soft bedding and overheating
  3. Breastfeeding, immunization, and pacifier use encouraged

### **Less discussed: Ethnic & Social Risk Factors / disparities**

1. Higher mortality among African American and Indigenous infants
2. Possible causes: poverty, housing conditions, limited healthcare access
3. Importance of culturally sensitive counseling

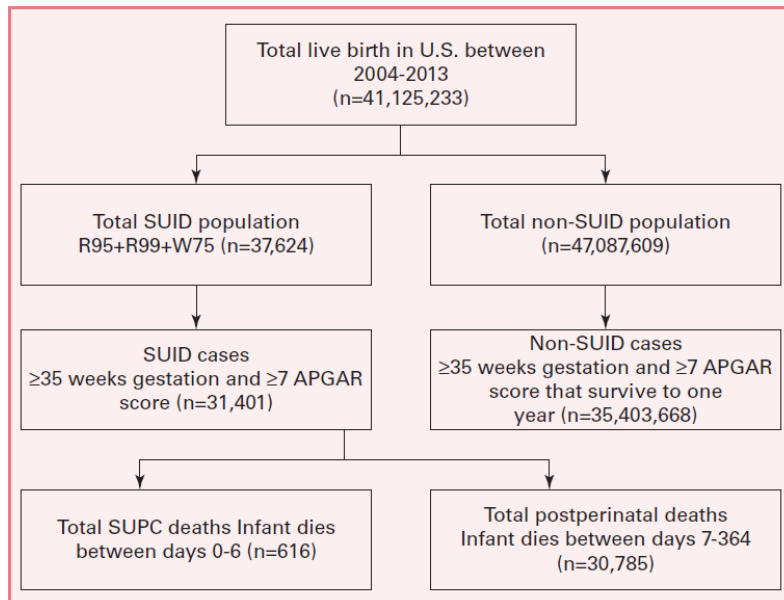
# SUPC always the same?

First report 2013 review of published cases

1/3 in first 2 hrs  
1/3 in 2 to 24 hrs  
1/3 1 to 7 days

Sudden Unexpected Postnatal Collapse of Newborn Infants: A Review of Cases, Definitions, Risks, and Preventive Measures Transl. Stroke Res. (2013) 4:236-247

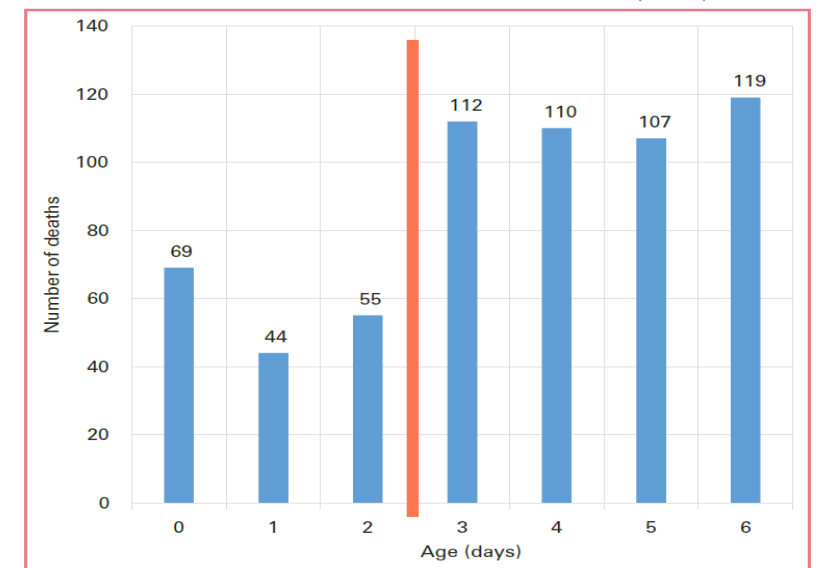
Eric Herlenius · Pierre Kuhn



- Interestingly not all cases happen in 48 to 72 hrs
- Only 22% in first 3 days

Andersen et al. MMC 2021 et al.

FIGURE 2. DISTRIBUTION OF SUPC DEATHS BY AGE (DAYS)



# SUPC out of hospital

- Estimated incidence ranges from 1.5 to 133 per 100,000 live births
- International differences in registration and prevention
- Deadly in over 50% of cases. 67% of deaths occur at home after 3 days
- Often occurs during feeding or direct skin-to-skin contact. If survived neurologic sequelae

## Factors Associated With Sudden Unexpected Postnatal Collapse

Jeffrey D. Colvin, MD, JD,<sup>a</sup> Esther Shaw, MS,<sup>b</sup> Matt Hall, PhD,<sup>a,c</sup> Rachel Y. Moon, MD<sup>d</sup>

PEDIATRICS Volume 154, number S3, November 2024

Of 6051 SUID deaths, 98 (1.6%) were SUPC

### **New Risk Factors strictly out of hospital (2024)**

1. Maternal age  $\geq$  40 years (adjusted OR 13.1), primiparous (adjusted OR 4.0)
2. Swaddling (adjusted OR 2.7), caregiver falling asleep while feeding (adjusted OR 2.6)
3. Sharing the sleep surface (adjusted OR 2.74)

# SUPC in hospital

- Often occurs during (first) feeding or direct Skin-to-skin contact (SSC) without monitoring / “left alone”
- Lack of supervision; sedation analgesia
- Prone positioning / “asphyxiating” position
- Caregiver falling asleep while not supervised breast feeding (“co bedding”)
- Primiparity, maternal age  $\geq 35$ , BMI  $> 25$
- Birth during nighttime hours; male sex slightly over represented
- Distraction (smart phones)

Evidence that lack of observation and / or monitoring during the transition to extrauterine life and airway obstruction are both contributing factors

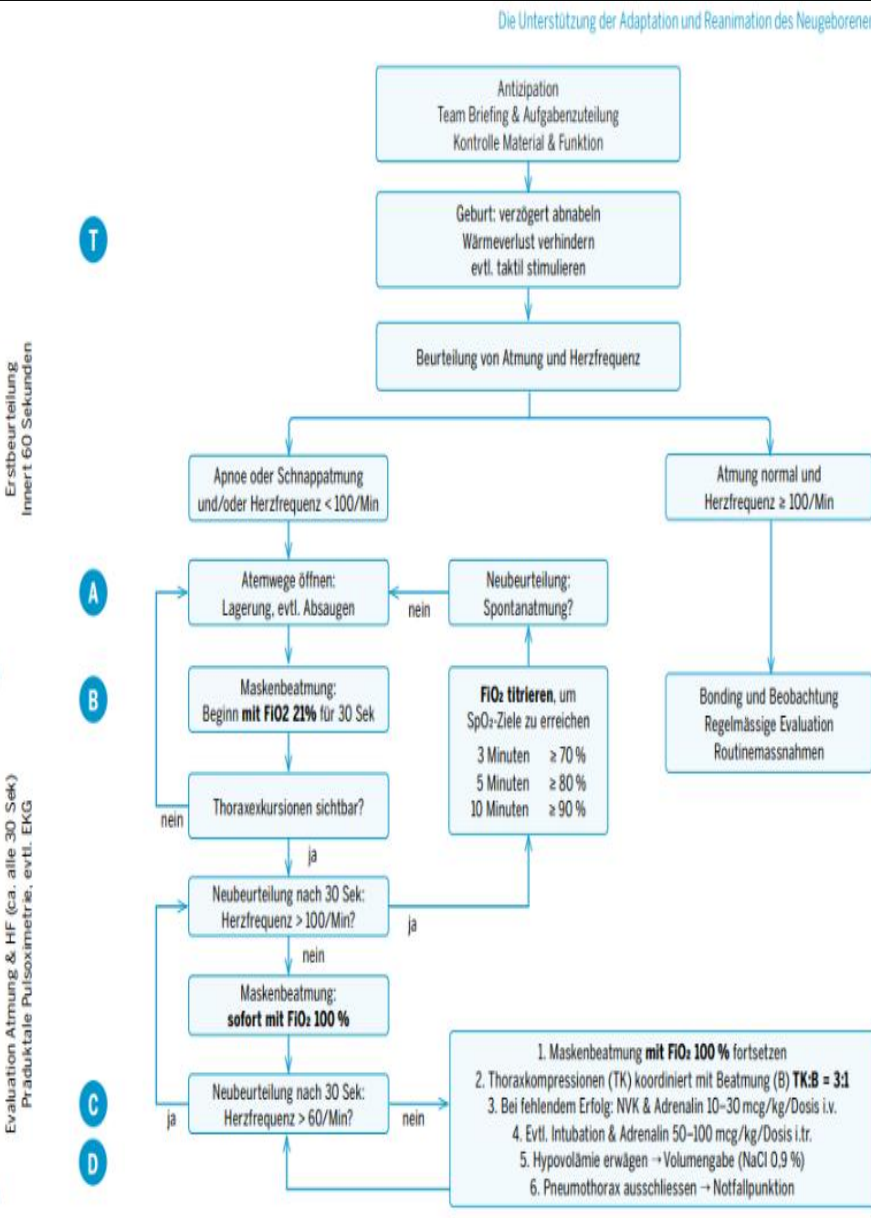
# SUPC in hospital

## Possible measures:

1. Close monitoring in the first hour after birth during early skin-to-skin care has been proposed as a preventive strategy.
2. Maybe: use pulse oximetry plus structured observation (“RAPP” respiratory; activity perfusion position assessment tool)
3. Targeted counseling for mothers with advanced maternal age and first-time parents
4. Emphasis on safe feeding and non-supine risks. Parental education.
5. Team awareness / check list?

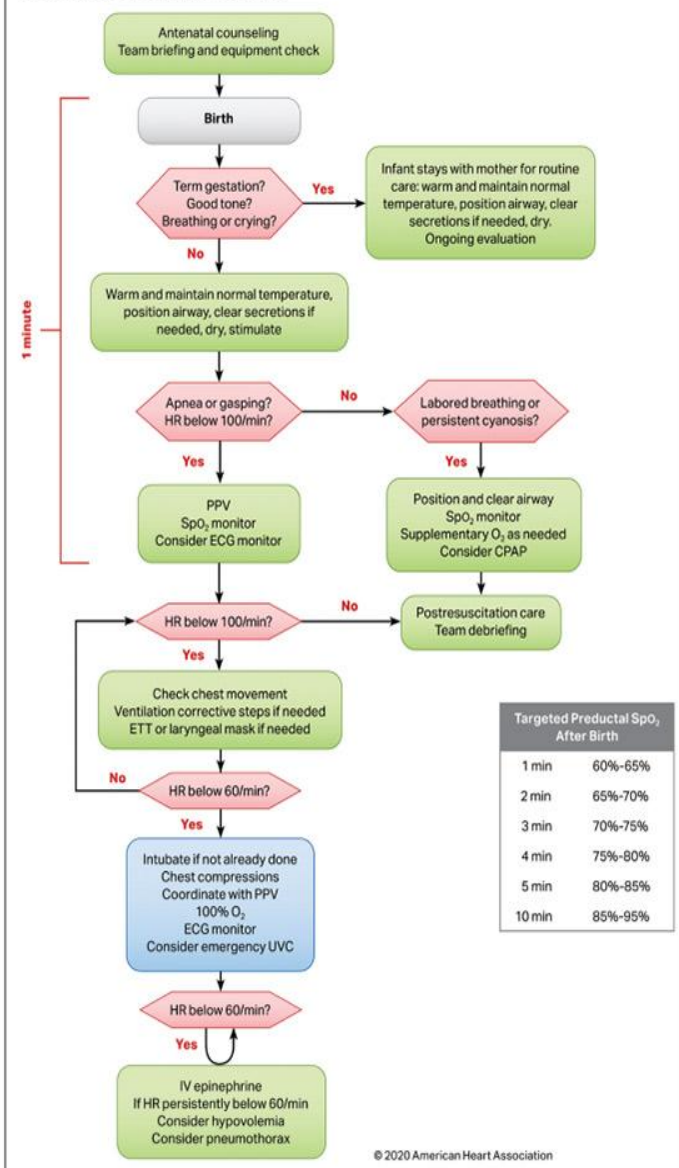
# SGN / ILCOR / PALS / ERC ...

Die Unterstützung der Adaptation und Reanimation des Neugeborenen

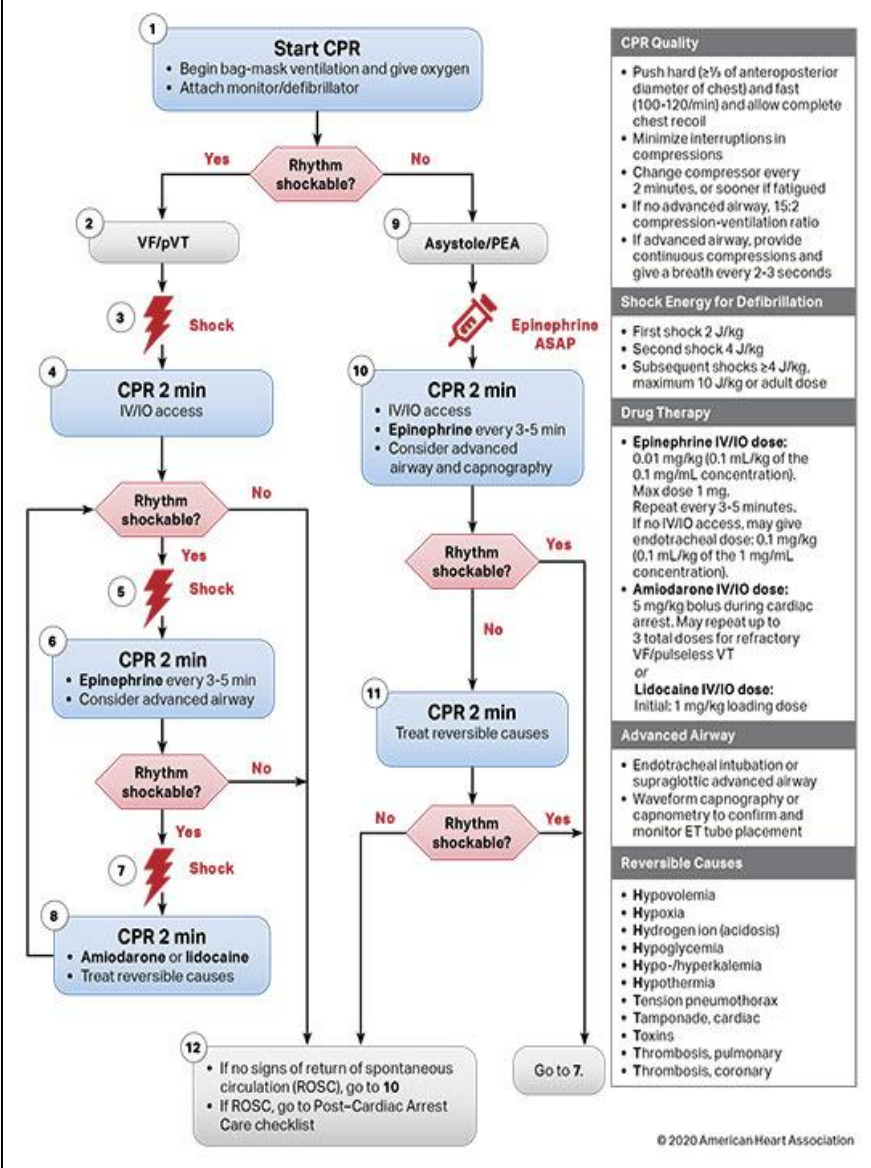


T  
 A  
 B  
 C  
 D  
 Erstbeurteilung Inner 60 Sekunden  
 Evaluation Atmung & HF (ca. alle 30 Sek)  
 Produktive Pulsoximetrie, evtl. EKG

## Neonatal Resuscitation Algorithm



## Pediatric Cardiac Arrest Algorithm



# Neonatal Resuscitation Overview 2021 Guidelines

- Ventilation is key to successful resuscitation. Effective ventilation takes precedence over chest compressions
- Use T-piece, flow-inflating bag, or self-inflating bag
- Max. 25 cm H<sub>2</sub>O initial peak inspiratory pressure <32 GA and 30 cm H<sub>2</sub>O >32 GA
- Adjust fraction of inspired O<sub>2</sub> by gestational age & saturations
- Delayed cord clamping recommended if infant is stable (≥34 weeks)
- Secure airway: face mask, supraglottic airway (SGA), or intubation

## Updates for the Neonatal Resuscitation Program and Resuscitation Guidelines

Gary M. Weiner, MD,\* Jeanette Zaichkin, RN, MN, NNP-BC†

**Table 2.** Neonatal Resuscitation Program, 8th edition, Practice Changes

Practice Change	NRP 7th Edition	NRP 8th Edition
Umbilical cord management added to prebirth questions	1. Gestational age? 2. Amniotic fluid clear? 3. How many infants? 4. Additional risk factors?	1. Gestational age? 2. Amniotic fluid clear? 3. Additional risk factors? 4. Umbilical cord management plan?
Initial steps reordered	Warm, position airway, clear secretions if needed, dry, stimulate	Warm, dry, stimulate, position airway, suction if needed
Earlier use of electronic cardiac monitor Simplified initial dose of epinephrine	When chest compressions start IV/IO dose range 0.01–0.03 mg/kg ET dose range 0.05–0.1 mg/kg	When an alternative airway is needed Suggested initial dose: IV/IO = 0.02 mg/kg ET = 0.1 mg/kg (while establishing vascular access) Flush IV/IO dose with 3 mL normal saline
Increased flush volume for intravascular epinephrine	Flush IV/IO dose with 0.5–1 mL normal saline	Flush IV/IO dose with 3 mL normal saline
Expanded timeframe for cessation of resuscitative efforts with confirmed absence of heart rate	Reasonable to stop after 10 minutes of resuscitation; however, decision should be individualized	If appropriate steps have been performed, consider cessation around 20 minutes after birth; however, decision should be individualized based on patient and contextual factors

ET=endotracheal, IO=intraosseous, IV=intravenous.

NRP 8th ed (2021); Kariuki et al. *BJA Educ* 2021; Drzymalski et al. *J Matern-Fetal Neonatal Med* 2022

Weiner et al. *NeoReviews* 2022; ILCOR (2023) Summary; Yamada et al. *Pediatrics* 2022

# 2021 (update 2023) guidelines

## TOP 10 TAKE-HOME MESSAGES FOR NEONATAL RESUSCITATION

1. For term and late preterm newborn infants  $\geq 34$  weeks' gestation who do not require resuscitation, delayed cord clamping ( $\geq 30$  seconds) can be beneficial compared with early cord clamping ( $< 30$  seconds).
2. For term and late preterm newborn infants  $\geq 34$  weeks' gestation who do not require resuscitation, intact cord milking is not known to be beneficial compared with delayed cord clamping ( $\geq 30$  seconds).
3. For nonvigorous term and late preterm newborn infants (35–42 weeks' gestation), intact cord milking may be reasonable compared with early cord clamping ( $< 30$  seconds).
4. For preterm newborn infants  $< 34$  weeks' gestation who do not require resuscitation, delaying cord clamping ( $\geq 30$  seconds) can be beneficial compared with early cord clamping ( $< 30$  seconds).

5. For preterm newborn infants between 28 and 34 weeks' gestation who do not require resuscitation and in whom delayed cord clamping cannot be performed, intact cord milking may be reasonable.
6. For preterm newborn infants  $< 28$  weeks' gestation, intact cord milking is not recommended.
7. Effective positive-pressure ventilation is the priority in newborn infants who need support after birth.
8. Using a T-piece resuscitator to deliver positive-pressure ventilation is preferred to the use of a self-inflating bag.
9. Because both T-piece resuscitators and flow-inflating bags require a compressed gas source to function, a self-inflating bag should be available as a backup in the event of compressed gas failure when using either of these devices.
10. Use of a supraglottic airway may be considered as the primary interface to administer positive-pressure ventilation instead of a face mask for newborn infants delivered at  $\geq 34$  0/7 weeks' gestation.



of these devices.

10. Use of a supraglottic airway may be considered as the primary interface to administer positive-pressure ventilation instead of a face mask for newborn infants delivered at  $\geq 34$  0/7 weeks' gestation.

Recommendation for Interfaces Used to Administer PPV for Newborn Infants		
COR	LOE	Recommendation
2b	C-LD	1. It may be reasonable to use a supraglottic airway as the primary interface to administer PPV instead of a face mask for newborn infants delivered at $\geq 34$ 0/7 wk' gestation.

<b>CLASS 2b (WEAK)</b>	<b>Benefit <math>\geq</math> Risk</b>	<b>LEVEL C-LD</b>	<b>(Limited Data)</b>
<b>Suggested phrases for writing recommendations:</b> <ul style="list-style-type: none"> <li>• May/might be reasonable</li> <li>• May/might be considered</li> <li>• Usefulness/effectiveness is unknown/unclear/uncertain or not well-established</li> </ul>		<ul style="list-style-type: none"> <li>• Randomized or nonrandomized observational or registry studies with limitations of design or execution</li> <li>• Meta-analyses of such studies</li> <li>• Physiological or mechanistic studies in human subjects</li> </ul>	

# Once upon a time 30 years ago

Anesthesiology, V 80, No 6, Jun 1994

## Neonatal Resuscitation Using the Laryngeal Mask Airway

Scott J. Paterson, M.D.,\* Paul J. Byrne, F.R.C.P.C.,† Marion G. Molesky, M.S.N.,‡ Robert F. Seal, F.R.C.P.C.,§ Brendan T. Finucane, F.R.C.P.C. ||



**Conclusions:** Providing PPV at birth *via* a size-1 LMA is effective and easily learned by personnel with expertise in neonatal resuscitation. The LMA should be further assessed as an alternative to bag-and-mask ventilation for this purpose. (Key words: Anesthesia, pediatric: neonatal. Equipment: laryngeal mask. Resuscitation.)

It was working  
then.....

**Table 1.** The Ventilation Corrective Steps (MR. SOPA)

Step	Description
MR.	Mask adjustment
	Reposition head and neck <ul style="list-style-type: none"> <li>• Give 5 breaths, check chest movement</li> <li>• If no chest movement, move to the next step</li> </ul>
SO	Suction mouth and nose
	Open mouth <ul style="list-style-type: none"> <li>• Give 5 breaths, check chest movement</li> <li>• If no chest movement, move to the next step</li> </ul>
P	Pressure increase in 5-10 cm increments (maximum 30-40 cm H <sub>2</sub> O) <ul style="list-style-type: none"> <li>• Give 5 breaths after each increment, check chest movement</li> <li>• If no chest movement at maximum pressure, move to next step</li> </ul>
A	Alternative airway (endotracheal tube or laryngeal mask) <ul style="list-style-type: none"> <li>• Confirm insertion</li> <li>• Assess heart rate after 30 seconds of PPV with chest movement</li> </ul>

Adapted from Weiner GM, Zaichkin J. *Textbook of Neonatal Resuscitation*. 8th ed. Itasca, IL: American Academy of Pediatrics; 2021. (5)

# Supraglottic Airways: Laryngeal Masks

2018

- Effective alternative if face mask ventilation is suboptimal
- Good evidence for term/late-preterm >2000 g or >34 wks (1500 g?)
- Reduce need for intubation. Shorter ventilation time
- Familiarity & availability barriers

2022

- Failure rate up to 25% for face mask
- No major difference in compressions or epinephrine usage
- Similar or lower orofacial trauma, gastric distention with LMA
- LMA as 'rescue device': ~90% success in failed mask ventilation
- Crucial to have LMA training, stock, and protocol integration at least as rescue airway
- If no improvement after ~30s of mask PPV, consider LMA
- 20–30s reduction in PPV duration with LMA vs face mask (RR 0.24)
- Higher success rates on first attempt with LMA (~90% vs ~75%) in some RCTs
- Significant fewer intubations (RR 0.34;  $p < 0.001$ ) with LMA approach



Supraglottic Airways Compared With Face Masks for Neonatal Resuscitation: A Systematic Review

# LMA Provider Experience & Training

- Surveys: ~12% of NRP providers have placed LMA clinically
- ~25% felt very / completely confident with LMA use
- Major barriers: availability, insufficient training, preference for face mask
- Only 6% of clinicians have received targeted training

# Laryngeal Mask: Rescue vs First-Line Steps to Encourage LMA Integration

- LMA recognized as a possible first-line approach in certain algorithms
- Hands-on manikin training or simulation for staff
- Ensure size 1 LMA in each delivery area
- Include LMA in local protocols for failed mask ventilation
- Train junior team members, midwives and nurses
- Encouraging more widespread training & supply in delivery rooms

# Wrap up

## Postneonatal collapse:

- Need for more standardised definition but in daily clinical practice all the abbreviations may not matter that much
- SUPC and SUEND (below 7 days) are rare and often catastrophic. SUPC cases in hospital but even more cases at home
- In hospital cases may benefit from prevention, counselling, team awareness plus monitoring & surveillance (staffing / midwife to newborn - mother ratio)
- Out of hospital cases may benefit even more so from specific parental education and prevention of co-sleeping and propagation of SIDS Guidelines

## Resuscitation and more:

- LMA more effective than face masks for many term/near-term newborns (early use?)
- Failure to improve with PPV and intubation rates are lowered with LMA
- Focus on training, device availability / LMA benefits





Spital Zollikerberg

Thank you very  
much for your  
attention

**TABLE 1** Summary of the most important changes in ERC guideline Newborn Resuscitation and Support of Transition of Infants at Birth 2021, see text for further details

Summary of changes
Delayed cord clamping after at least 60 s <sup>a</sup>
No routine suctioning of newborn infants born through meconium-stained liquor <sup>b</sup>
The laryngeal mask as an acceptable alternative airway
Starting FiO <sub>2</sub> in preterm newborn infants: <28 weeks: 30% 28–32 weeks: 21%–30% ≥32 weeks: 21%
Starting peak inspiratory pressure of 25 cm H <sub>2</sub> O in preterm newborn infants of <32 weeks gestation
Two-thumb-encircling technique for chest compressions
An UVC as the optimal route of vascular access with IO as an acceptable alternative in emergencies
Giving adrenaline every 3–5 min if the heart rate does not increase after ventilation and chest compressions
Administering glucose in a prolonged resuscitation
Consider stopping the resuscitation if there is no response after 10–20 min of optimal resuscitation

Abbreviations: FiO<sub>2</sub>, fraction of inspired oxygen; UVC, umbilical vein catheter; IO, intraosseous.

<sup>a</sup>In the absence of contraindications, for instance placental abruption or maternal hemorrhage.

<sup>b</sup>The emphasis should be on aeration and ventilation of the lungs.