Clinical question.

In depressed neonates with clear amniotic fluid (P), does suctioning of the mouth and nose (I) versus none (C) improve outcome (O)?

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

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

Conflict of interest specific to this question

Do any of the authors listed above have conflict of interest disclosures relevant to this worksheet? No conflict of interest

Search strategy (including electronic databases searched).

**PUBMED:** Terms used to search “Resuscitation”; “Heart arrest”; “Suction”; “Delivery, obstetrics”; Delivery, rooms”; all as MESH headings

Different combinations but all excluded “Meconium” OR “Meconium aspiration” were used.

Results with different combinations

1. “Heart arrest” OR “Resuscitation” AND “Suction” AND “Delivery, obstetric” OR “Delivery, rooms” NOT “Meconium” OR “Meconium aspiration syndrome” – 12 articles but only 2 selected for review

2. “Heart arrest” OR “Resuscitation” AND “Suction” NOT “Meconium” OR “Meconium aspiration syndrome” – 423 articles; then limited to neonates and got 90 articles but only 11 were selected for review

3. “Suction” AND “Delivery, obstetric” OR “Delivery, rooms” NOT “Meconium” OR “Meconium aspiration syndrome” – Retrieved 57, but only 7 selected for review

**EMBASE:** “Resuscitation/exp/mj OR Resuscitation” AND “Suction/exp/mj OR Suction” NOT “Meconium” OR “meconium aspiration syndrome” - Got 210 hits, limited to neonates- got 26 hits

“Delivery/exp/mj OR Delivery” AND “Suction/exp/mj OR Suction” NOT “Meconium” OR “meconium aspiration syndrome” ; limited to neonates- 52 hits

**COCHRANE:** “Resuscitation (text)” OR “Resuscitation (MESH)” AND “Suction (text)” OR “Suction (MESH)” – Got 8 Cochrane reviews, 3 Other reviews, 93 clinical trials

**ECC ENDNOTE:** Terms used to search “Depressed baby, infant, neonate”; “Clear amniotic fluid, amniotic fluid”; “Suction mouth, orophyranx”; “No suction” and all MESH headings

Different combinations but all without the term “Meconium” OR “Meconium aspiration” were used.

Results with different combinations of words was as follows:

“depressed neonates/babies” OR “clear amniotic fluid” OR “no suction” – 44 articles

“depressed neonates” AND “amniotic fluid” OR “suction”- 1 article

“depressed baby” OR “amniotic fluid” OR “suction”-1 article

“depressed neonates” OR “clear amniotic fluid” OR “suction orophyranx”-5 articles

“depressed babies” OR “clear amniotic fluid” OR “suction orophyranx”-3 articles

• State inclusion and exclusion criteria
Included were the studies that looked at the effects of suctioning including those that compared suction to no suction or baseline. No clinical studies were found that looked at use of suction in depressed infants in the delivery room nor use of suction during resuscitation. Therefore studies included for review included studies that looked at use of suction in normal newborns or in those who were ventilated with or without sedation. The following articles were excluded: Suction not the major topic of the study or studied in combination with other interventions (20); Suctioning not involving clearing of the airway (76); Letters or editorials (20), Case reports (6), Reviews (14) but reviews were searched for appropriate references.

- Number of articles/sources meeting criteria for further review:
  18 articles, all were LOE 5 regarding the topic in reviewed (different patient/ population) though some of them were randomized clinical studies
Summary of evidence

Evidence Supporting Clinical Question

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<th>Good</th>
<th>Fair</th>
<th>Poor</th>
<th>Level of evidence</th>
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<td>Waltman, 2004 E3</td>
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Evidence Neutral to Clinical question

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<td>Estol, 1992 E1, E2</td>
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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
E1- Pulmonary compliance, E2- Respiratory resistance, E3- Oxygen saturation (SpO2), E4- Heart Rate, E5- Apgar score, E6- Blood pressure, E7- Arterial oxygen (PaO2), E8- Cerebral perfusion, E9- Cerebral blood flow velocity, E10- Cerebral blood volume, E11- Brain oxygenation
### Evidence Opposing Clinical Question

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- **Gungor, 2005 E3, E4**
- **Gungor, 2006 E3, E4, E5**
- **Waltman, 2004 E4**
- **Carrasco, 1997 E3**
- **Guglielminotti, 1998 E2**
- **Brandstater, 1969 E1**
- **Morrow, 2006 E1**
- **Simbruner, 1981 E3, E4, E6**
- **Gonzalez-Cabello, 2005 E3**
- **Kerem, 1990 E7**
- **Fanconi, 1987 E8**
- **Perlman, 1983 E9**
- **Kaiser, 2007 E9**
- **Shah, 1992 E10, E3**
- **Skov, 1992 E11**
- **Cordero, 1971 E4**

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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
- **E1** - Pulmonary compliance, **E2** - Respiratory resistance, **E3** - Oxygen saturation (SpO2), **E4** - Heart Rate, **E5** - Apgar score, **E6** - Blood pressure, **E7** - Arterial oxygen (PaO2), **E8** - Cerebral perfusion pressure, **E9** - Cerebral blood flow velocity, **E10** - Cerebral blood volume, **E11** - Brain oxygenation
**REVIEWER’S FINAL COMMENTS AND ASSESSMENT OF BENEFIT / RISK:**

**Introduction:** The primary purpose of suctioning the airway is to remove secretions and prevent airway obstruction thereby optimizing ventilation and oxygenation. Sustaining ventilation and oxygenation is critical during resuscitation of the newborn. Depressed infants are unable to clear their own airway, therefore these infants are often suctioned. Ventilation results in intermittent gas flow into and out of the lungs, whereas suctioning is a continuous flow out of the lung, therefore suctioning interferes with ventilation. It is important not to interfere with ventilation during resuscitation unless there are benefits in doing so. It is not clear if regular suctioning of depressed infants has any benefit or associated risks. In this review we looked at the effects of suctioning in newborns with or without endotracheal intubation.

**Comments:** We could not find studies that looked at suctioning of the mouth and nose in depressed neonates with clear amniotic. But there are studies that have looked at oro-nasopharyngeal suctioning in non-depressed or healthy term neonates (2, 3, 4, 8, 9, 18). Four of these studies were randomized clinical trials (2,8,9,18), one quasi-randomized (4) and one was a series of case reports (3). Most of these studies reported that oro-nasopharyngeal suctioning is associated with bradycardia, apnea and delays in achieving normal oxygenation. Some of the depressed infants might need intubation, therefore we also reviewed studies that looked at the effects of endotracheal suctioning in intubated infants. Endotracheal suctioning is associated with decreased pulmonary compliance (1,12), increased airway resistance (7), decreased oxygenation (6,11,15), increased blood pressure (5,10,13,16), increased cerebral blood flow (10,13,15) and increased intracranial pressure (5,13,.). In the presence of secretions or increased resistance before suctioning, suctioning results in a decrease in resistance (14). Therefore suctioning is associated with increased risk of developing cardio-respiratory and increased cerebral blood flow which might be complicated by intraventricular haemorrhage in premature infants. Overall all the studies listed above enrolled small numbers. There is a gap in knowledge regarding the effects of suctioning in depressed infants during resuscitation. From what has been reported it would appear that there is no benefit to suction well neonates, except in those with secretions.

**Acknowledgements:**

Citation List
1. Brandstater B, Muallem M
Anaesthesiology 1969

Summary by worksheet reviewers
Authors studied six newborns that were treated with ventilators for neonatal tetanus. They were subjected to repeated tracheal suction to keep airway clean. Authors measured before, during and after tracheal suction. They found that tracheal suction was associated with increased transpulmonary pressure and loss of lung volume, suggesting that suctioning is detrimental. Fair, Opposing, LOE 5

2. Oro-nasopharyngeal suction at birth: effects on arterial oxygen saturation.
Carrasco M, Martell M, Estol PC.
J. Pediatr 1997;130:832-4

Comment: According to this study, ONPS should not be performed as a routine procedure in normal, term, vaginally born infants Good, Opposing, LOE 5

3. Neonatal bradycardia following nasopharyngeal stimulation.
Cordero L Jr, Hon EH.
J. Pediatr 1971;78:441-447

Summary by worksheet reviewers
Authors observed that suctioning of nasopharynx is a widely used procedure in normal and abnormal babies. They also observed that it leads to cardiac arrhythmia. They studied the effect of suctioning with a continuous recording of heart rate and EKG in infants at 1min to 1hr of life in 87 newborns. After delivery 41 infants received repeated nasopharyngeal suction with bulb syringe. In these infants no change in heart rates were noted. In other 46 neonates were suctioned with a nasogastric tube which was connected to DeLee trap. In these infants suctioning caused severe cardiac arrythmias. In six babies. Five infants also became apneic. Authors concluded that nasogastric tube suctioning is associated with cardiac arrhythmias. Poor, opposing, LOE 5

4. Oro-naso-pharyngeal suction at birth: effects on respiratory adaptation of normal term vaginally born infants.
Estol PC, Piriz H, Basalo S, Simini F, Grela C.

Comment: The results obtained in this study provide no physiological basis to recommend routine airway suction at birth in normal, term, vaginally born infants. Fair, Neutral, LOE 5

5. Intratracheal suctioning in sick preterm infants: prevention of intracranial hypertension and cerebral hypoperfusion by muscle paralysis.
Fanconi S, Duc G.
Pediatrics 1987;79:538-543

Comments: This study showed endotracheal suctioning caused slight increase in on BP in non paralyzed infants, Cerebral perfusion pressure also decreased in non paralzyed infants Fair, Opposing, LOE 5

González-Cabello H, Furuya ME, Vargas MH, Tudón H, Garduño J, González-Ayala J.
**Pediatr Pulmonol 2005;39:46-50**

**Comments:** The study shows tracheal suction causes hypoxemia, which can be prevented by administering 10% higher oxygen than base line prior to suctioning. **Fair, Opposing, LOE 5**

7. Effects of tracheal suctioning on respiratory resistances in mechanically ventilated patients.  
*Guglielminotti J, Desmonts JM, Dureuil B.*  
*Chest 1998;113:1335-38*

**Comment:** Tracheal suction causes broncho constriction. **Fair, Opposing, LOE 5**

8. Oronasopharyngeal suction versus no suction in normal and term infants delivered by elective caesarean section: a prospective randomized controlled trial.  
*Gungor S, Kurt E, Teksoz E, Goktolga U, Ceyhan T, Baser I.*  
*Gynecol Obstet Invest 2006;61:9-14*

**Comment:** Oropharyngeal suction in infants born by C section caused desaturation. **Good, opposing, LOE 5**

9. Oronasopharyngeal suction versus no suction in normal, term and vaginally born infants: a prospective randomised controlled trial.  
*Gungor S, Teksoz E, Ceyhan T, Kurt E, Goktolga U, Baser I.*  
*Aust N Zealand J Obstet Gynaecol 2005;45:453-456*

**Comment:** Oropharyngeal suction at birth in normal term infants suctioning prolonged reaching normal oxygen saturation. **Good, opposing, LOE 5**

10. Tracheal suctioning is associated with prolonged disturbances of cerebral hemodynamics in very low birth weight infants.  
*Kaiser JR, Gauss CH, Williams DK.*  
*J Perinatol 2008;28:34-41*

**Comment:** This study shows concern regarding increase in cerebral blood flow following suction in VLBW infants, therefore suctioning may be harmful. **Fair, Opposing, LOE 5**

*Kerem E, Yatsiv I, Goitein KJ.*  
*Intensive Care Med 1990;16:95-99*

**Comment:** Suction causes hypoxemia. These studies show beneficial effect of pre oxygenation before suctioning to prevent suction related hypoxemia. **Fair, Opposing, LOE 5**

12. Effect of endotracheal suction on lung dynamics in mechanically-ventilated paediatric patients.  
*Morrow B, Futter M, Argent A.*  
*Aust J Physiotherapy 2006;52:121-126*

**Comment:** The study demonstrates that suctioning is associated with loss of lung volume and decrease in compliance. **Fair, Opposing, LOE 5**

13. Suctioning in the preterm infant: effects on cerebral blood flow velocity, intracranial pressure, and arterial blood pressure.
Perlman JM, Volpe JJ. 

Comments: Studies underscore the deleterious effect of suctioning on cerebral blood flow velocity and risk of IVH in preterm infants. Fair, Opposing, LOE 5

Prendiville A, Thomson A, Silverman M. 
Arch Dis Childhood 1986;61:1178-1183

Comment: Tracheal suction in intubated infants decreased airway resistance and time constant, thus helped two infants. Fair, Supportive in presence of secretions, Neutral in absence of secretions, LOE 5.

15. Fluctuations in cerebral oxygenation and blood volume during endotracheal suctioning in premature infants. 
Shah AR, Kurth CD, Gwiazdowski SG, Chance B, Delivoria-Papadopoulos M. 
J Pediatr 1992;120:769-74

Comments: Endotracheal suction besides causing transient hypoxemia also cause cerebral vasodilation and deoxygenation. Fair, Opposing, LOE 5

Arch Dis Childhood 1981;56:326-330

Comment: These studies in low birth infants on assisted ventilation showed adverse effect of tracheal suctioning on oxygenation. Fair, Opposing, LOE 5

17. Changes in cerebral oxygenation and cerebral blood volume during endotracheal suctioning in ventilated neonates. 
Skov L, Ryding J, Pryds O, Greisen G. 

Comments: The authors conclude that whereas preoxygenation prior to suctioning ameliorate brain oxygenation, but does not ameliorate the stress. Fair, Opposing, LOE 5

Waltman PA, Brewer JM, Rogers BP, May WL. 
J Midwifery Womens Health 2004;49:32-38

Comment: This study in a small group of term infants shows that bulb suctioning at birth caused statistically lower heart rate but had no clinical significance. Bulb suctioning was safe. Good, Supportive on saturations, opposing on heart rate, LOE5.