QUESTION

Should ETT suction vs. No ETT suction be used for non-vigorous infants: a systematic review and meta-analysis?

POPULATION:	Non-vigorous infants delivered through meconium-stained amniotic fluid :a systematic review and meta-analysis
INTERVENTION:	ETT suction
COMPARISON:	No ETT suction
MAIN OUTCOMES:	Survival at discharge; Survival at discharge (obs); Mental neurodevelopmental impairment; Motor neurodevelopmental impairment; Hypoxic ischemic encephalopathy; Hypoxic ischemic encephalopathy (obs) ; Meconium aspiration syndrome; Meconium aspiration syndrome (obs); Mechanical ventilation; Mechanical ventilation (obs); Respiratory support (excluded mechanical ventilation); DR interventions - ETT for PPV; Delivery room interventions (chest compressions); Delivery room interventions (chest compressions) (obs); Delivery room interventions (epinephrine); Treatment of pulmonary hypertension (iNO, oral medications, ECMO); Length of hospitalization; Length of hospitalization (obs);
SETTING:	Delivery suites
PERSPECTIVE:	
BACKGROUND:	Up to 20% of all births are affected by meconium stained amniotic fluid. About 5% of those exposed to meconium stained amniotic fluid aspirate the fluid into their lungs resulting in significant illness after birth called Meconium Aspiration Syndrome (Wiswell 1993, 955; Singh 2009, 497). Infants born through MSAF who are nonvigorous represent 1.5% to 3% of all births. When contemplating the worldwide number of births, this question impacts significant number of babies annually (Almeida 2017, 576; Qian 2008, 1115; Bhat 2008, 199). The controversy around the 2015 recommendation for abandoning routine endotracheal suctioning continues to rage, as evidenced by recent randomized trials (Chettri 2015, 1208, Nangia 2016, 79, Singh 2018) and one retrospective study (Chirovolu 2018). Current practice in caring for newborns delivered through meconium-stained amniotic fluid includes immediate resuscitation without laryngoscopy, immediate laryngoscopy with subjective determination of need for tracheal suctioning and immediate laryngoscopy with tracheal suctioning.
CONFLICT OF INTERESTS:	Authors declare they have not conflicts of interest.

ASSESSMENT

Problem

Is the problem a priority?

JUDGEMENT	RESEARCH EVIDENCE	ADDITIONAL CONSIDERATIONS
○ No ○ Probably no ● Probably yes ○ Yes ○ Varies ○ Don't know	Up to 20% of all births are affected by meconium stained amniotic fluid. About 5% of those exposed to meconium stained amniotic fluid aspirate the fluid into their lungs resulting in significant illness after birth called Meconium Aspiration Syndrome (Wiswell 1993, 955; Singh 2009, 497). Infants born through MSAF who are non-vigorous represent 1.5% to 3% of all births. When contemplating the worldwide number of births, this question impacts significant number of babies annually (Almeida 2017, 576; Qian 2008, 1115; Bhat 2008, 199). The controversy around the 2015 recommendation for abandoning routine endotracheal suctioning continues to rage, as evidenced by recent randomized	

	trials (Chettri 2015, 1208, Nangia 2016, 79, Singh 2018) and one retrospective study (Chirovolu 2018). Current practice in caring for newborns delivered through meconium-stained amniotic fluid includes immediate resuscitation without laryngoscopy, immediate laryngoscopy with subjective determination of need for tracheal suctioning and immediate laryngoscopy with tracheal suctioning.	

Desirable Effects

How substantial are the desirable anticipated effects?

JUDGEMENT	RESEARCH EVIDENCE	ADDITIONAL CONSIDERATIONS
● Trivial ○ Small ○ Moderate ○ Large ○ Varies ○ Don't know	Severe asphyxia is a common condition in non-vigorous infants delivered through meconium-stained amniotic fluid. Initiating ventilation within the first minute of life in non-breathing or ineffectively breathing infants is strongly recommended. Delay in initiating ventilation, especially where the provider is unable to promptly intubate the infant or suction attempts are repeated, may negatively impact critical outcomes (i.e. survival, long-term neurodevelopmental outcomes). On the other hand, elective suctioning of the upper airways could reduce incidence and severity of the respiratory disease (MAS). If there was a finding of benefit of the intervention, this could be a large benefit for the individual, family, and population. However, our review of the evidence found no significant benefit. If there was a finding of harm of the intervention, this could lead to large degree of harm for the individual, family, and population. However, our review of the evidence found no significant concern for harm of the intervention.	

Undesirable Effects

How substantial are the undesirable anticipated effects?

JUDGEMENT	RESEARCH EVIDENCE	ADDITIONAL CONSIDERATIONS
○ Large ○ Moderate ○ Small ● Trivial ○ Varies ○ Don't know	Severe asphyxia is a common condition in non-vigorous infants delivered through meconium-stained amniotic fluid. Initiating ventilation within the first minute of life in non-breathing or ineffectively breathing infants is strongly recommended. Delay in initiating ventilation, especially where the provider is unable to promptly intubate the infant or suction attempts are repeated, may negatively impact critical outcomes (i.e. survival, long-term neurodevelopmental outcomes). On the other hand, elective suctioning of the upper airways could reduce incidence and severity of the respiratory disease (MAS). If there was a finding of benefit of the intervention, this could be a large benefit for the individual, family, and population. However, our review of the evidence found no significant benefit. If there was a finding of harm of the intervention, this could lead to large degree of harm for the individual, family, and population. However, our review of the evidence found no significant concern for harm of the intervention.	

Certainty of evidence

What is the overall certainty of the evidence of effects?

JUDGEMENT	RESEARCH EVIDENCE	ADDITIONAL CONSIDERATIONS

○ Very low ● Low ○ Moderate ○ High ○ No included studies	The certainty of evidence was low for the primary outcome (survival at discharge) and ranged from very low to low for secondary outcomes (neurodevelopmental impairment, incidence of MAS, need for intubation, chest compressions and medications in delivery room, duration of hospital stay, etc...).	

Values
Is there important uncertainty about or variability in how much people value the main outcomes?

JUDGEMENT	RESEARCH EVIDENCE	ADDITIONAL CONSIDERATIONS
○ Important uncertainty or variability ○ Possibly important uncertainty or variability ● Probably no important uncertainty or variability ○ No important uncertainty or variability	Despite available studies that were considered to have a high risk of bias, and the certainty of evidence ranged from low to very low for the considered outcomes, the taskforce considers that there is probably no important uncertainty or variability in how much people value the main outcomes.	

Balance of effects
Does the balance between desirable and undesirable effects favor the intervention or the comparison?

JUDGEMENT	RESEARCH EVIDENCE	ADDITIONAL CONSIDERATIONS
○ Favors the comparison ● Probably favors the comparison ○ Does not favor either the intervention or the comparison ○ Probably favors the intervention ○ Favors the intervention ○ Varies ○ Don't know	The taskforce places value on both harm avoidance (delays in providing bag-mask ventilation, potential harm of the procedure) and the unknown benefit of the intervention of routine laryngoscopy with or without tracheal intubation and suctioning. Routine practice of this intervention for non-vigorous infants is more likely to result in delays in initiating ventilation, especially where the provider is unable to promptly intubate the infant or suction attempts are repeated. In the absence of evidence of benefit for suctioning, the emphasis should be on initiating ventilation within the first minute of life in non-breathing or ineffectively breathing infants.	

Resources required
How large are the resource requirements (costs)?

JUDGEMENT	RESEARCH EVIDENCE	ADDITIONAL CONSIDERATIONS

○ Large costs ○ Moderate costs ○ Negligible costs and savings ● Moderate savings ○ Large savings ○ Varies ○ Don't know	Routine practice of laryngoscopy with or without tracheal intubation and suctioning would require increased personnel, training, and equipment. Therefore, there would be potentially moderate savings in costs for not routinely performing the intervention. On the other hand, equipment for suctioning and intubation and trained personnel should be available at every delivery (independently from the presence of meconium stained amniotic fluid).	

Certainty of evidence of required resources

What is the certainty of the evidence of resource requirements (costs)?

JUDGEMENT	RESEARCH EVIDENCE	ADDITIONAL CONSIDERATIONS
○ Very low ○ Low ● Moderate ○ High ○ No included studies	The costs were not reported in the included studies. However, as the critical outcomes (survival at discharge, NDI, MAS) and the important outcomes (i.e. need for ventilation, treatment of pulmonary hypertension, duration of hospitalization) were similar between intervention and comparison group, the certainty of the evidence of the required resources seems to be moderate.	

Cost effectiveness

Does the cost-effectiveness of the intervention favor the intervention or the comparison?

JUDGEMENT	RESEARCH EVIDENCE	ADDITIONAL CONSIDERATIONS
○ Favors the comparison ● Probably favors the comparison ○ Does not favor either the intervention or the comparison ○ Probably favors the intervention ○ Favors the intervention ○ Varies ○ No included studies	The critical outcomes (survival at discharge, NDI, MAS) and the important outcomes (i.e. need for ventilation, treatment of pulmonary hypertension, duration of hospitalization) were similar between the intervention and comparison group. As the intervention group would require more equipment use, the cost-effectiveness probably favors the comparison group.	

Equity
What would be the impact on health equity?

JUDGEMENT	RESEARCH EVIDENCE	ADDITIONAL CONSIDERATIONS
○ Reduced ○ Probably reduced ○ Probably no impact ○ Probably increased ● Increased ○ Varies ○ Don't know	In low-resource settings, equipment and adequately trained personnel to perform the intervention are not always available. An intervention that does not include direct laryngoscopy with or without tracheal intubation and suctioning is more likely to increase health equity globally, including in low-resource settings where the largest incidence of non-vigorous infants delivered through meconium-stained amniotic fluid occurs.	

Acceptability
Is the intervention acceptable to key stakeholders?

JUDGEMENT	RESEARCH EVIDENCE	ADDITIONAL CONSIDERATIONS
○ No ○ Probably no ○ Probably yes ● Yes ○ Varies ○ Don't know	The intervention is acceptable to key stakeholders.	

Feasibility
Is the intervention feasible to implement?

JUDGEMENT	RESEARCH EVIDENCE	ADDITIONAL CONSIDERATIONS
○ No ○ Probably no ● Probably yes ○ Yes ○ Varies ○ Don't know	From a practical point of view, avoiding routine laryngoscopy with or without tracheal intubation and suctioning is feasible and easy to implement. Despite new studies that have become available after the 2015 recommendation, this review shows that the certainty of evidence remains low or very low. However, the uncertainty of these results could limit the implementation of the recommendation among clinicians.	

SUMMARY OF JUDGEMENTS

	JUDGEMENT						
PROBLEM	No	Probably no	**Probably yes**	Yes		Varies	Don't know
DESIRABLE EFFECTS	**Trivial**	Small	Moderate	Large		Varies	Don't know
UNDESIRABLE EFFECTS	Large	Moderate	Small	**Trivial**		Varies	Don't know

CERTAINTY OF EVIDENCE	Very low	**Low**	Moderate	High			No included studies
VALUES	Important uncertainty or variability	Possibly important uncertainty or variability	**Probably no important uncertainty or variability**	No important uncertainty or variability			
BALANCE OF EFFECTS	Favors the comparison	**Probably favors the comparison**	Does not favor either the intervention or the comparison	Probably favors the intervention	Favors the intervention	Varies	Don't know
RESOURCES REQUIRED	Large costs	Moderate costs	Negligible costs and savings	**Moderate savings**	Large savings	Varies	Don't know
CERTAINTY OF EVIDENCE OF REQUIRED RESOURCES	Very low	Low	**Moderate**	High			No included studies
COST EFFECTIVENESS	Favors the comparison	**Probably favors the comparison**	Does not favor either the intervention or the comparison	Probably favors the intervention	Favors the intervention	Varies	No included studies
EQUITY	Reduced	Probably reduced	Probably no impact	Probably increased	**Increased**	Varies	Don't know
ACCEPTABILITY	No	Probably no	Probably yes	**Yes**		Varies	Don't know
FEASIBILITY	No	Probably no	**Probably yes**	Yes		Varies	Don't know

TYPE OF RECOMMENDATION

Strong recommendation against the intervention	**Conditional recommendation against the intervention**	Conditional recommendation for either the intervention or the comparison	Conditional recommendation for the intervention	Strong recommendation for the intervention
○	●	○	○	○

CONCLUSIONS

Recommendation

For non-vigorous newborns delivered through meconium-stained amniotic fluid, the available published human evidence suggests against routine immediate direct

laryngoscopy after delivery with or without tracheal suctioning when compared to immediate resuscitation without direct laryngoscopy. Meconium stained amniotic fluid remains a significant risk factor for receiving advanced resuscitation in the delivery room. Intubation and suctioning is the appropriate response if the airway is obstructed.

Justification

Overall justification
The Treatment Recommendation is based on review and evaluation of several studies that have been added to the literature since the last recommendation was made. While these studies contribute important evidence regarding this topic, the certainty of the findings remains low or very low due to the difficulty of performing unbiased studies of this clinical question.
In making this suggestion, we place value on both harm avoidance (delays in providing bag-mask ventilation, **potential harm of the procedure**) and the unknown benefit of the intervention of routine tracheal intubation and suctioning.

Routine suctioning of nonvigorous infants is more likely to result in delays in initiating ventilation, especially where the provider is unable to promptly intubate the infant or suction attempts are repeated. In the absence of evidence of benefit for suctioning, the emphasis should be on initiating ventilation within the first minute of life in non-breathing or ineffectively breathing infants.
Detailed justification
Undesirable Effects
The Taskforce considered the potential for harm in the procedure of endotracheal intubation and the delay of positive pressure ventilation with the intervention, for which there was no evidence of benefit.
Certainty of evidence
The certainty of evidence for benefit of the intervention remained low to very low.
Values
The Taskforce considered that the procedure of laryngoscopy with or without tracheal intubation and suctioning is invasive and has potential for harm. The context of no evidence for benefit led to the suggestion against routine practice of the intervention. While immediate intubation and tracheal suctioning after birth is not routinely suggested, the likelihood of intubation for resuscitation remains a strong possibility. Therefore, trained personnel and equipment for intubation should be readily available for deliveries where meconium stained amniotic fluid is present. This includes the potential use of a meconium aspirator after intubation, as in cases of airway obstruction, where the only means of relieving the obstruction could be tracheal suctioning.

Subgroup considerations

The criteria for subgroup analyses were not met.

Implementation considerations

Implementation will not require further equipment or resources compared to current practice. There may be a decrease in use of equipment due to reduced use of supplies for laryngoscopy, intubation, and suctioning. However, there will not be reduced need for personnel or training. Meconium stained amniotic fluid is a risk factor for receiving advanced neonatal resuscitation. Therefore, appropriate personnel and equipment should always be available.

Monitoring and evaluation

As practice recommendations have changed over the past two decades, and there are no current large clinical trials to inform this question for which there is no evidence of benefit, continued monitoring and evaluation is highly recommended.

Research priorities

Does the potential for harm (i.e. delay in starting positive pressure ventilation or transient bradycardia/ hypoxia, mortality, NDI) outweigh the potential for benefit (i.e. reduction of MAS, need for mechanical ventilation or treatment of pulmonary hypertension)?
Long-term outcomes should be included in future studies. The neurodevelopmental, behavioral, or educational assessment for future studies should be at or after 18 months of age and completed with a validated tool.