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Contents lists available at ScienceDirect

Early Human Development

journal homepage: www.elsevier.com/locate/earlhumdev



The suctioning in the delivery room debate

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ARTICLE INFO

Keywords:

Meconium-stained amniotic fluid
Meconium aspiration
Infant
Intrapartum suction
Intubation

ABSTRACT

Meconium aspiration syndrome (MAS) is a life threatening respiratory disorder in infants born through meconium-stained amniotic fluid (MSAF). Its obstetric and perinatal management has been changing for over 35 years. In pregnancies complicated by MSAF, suction of the hypopharynx before the delivery of the infant's shoulders and postnatal suction of vigorous infants have been used in an effort to clear the airway and decrease the incidence and the severity of the disease. Based on the results of two large RCTs, international guidelines from scientific societies for intrapartum and postpartum management of pregnancies with MSAF have radically changed. Intrapartum suction and postnatal intubation and suction of vigorous infants are not longer recommended. For depressed infants there are no randomized trials to support or to refute this practice. Other non recommended manoeuvres such as thorax compression and gastric lavage are still sometimes performed. The adherence to norms and recommendations is not uniform. Neonatologists should make efforts to get the new evidence more quickly move to evidence-based clinical practice.

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1. Introduction

The frequency of meconium-stained amniotic fluid (MSAF) ranges from 4 to 14% of pregnancies depending mainly on the mean gestational age. In fact, it is present in around 38% of 41-week GA pregnancies and it is quite unusual before 31 weeks GA [1–4].

Acute foetal distress has been associated with MSAF, but the only proven association has been with foetal maturity [5]. What does the presence of meconium mean? Is it a synonym of foetal distress and/or asphyxia? The release of meconium into the amniotic fluid can occur in different circumstances: stress (hypoxia, acidosis and/or infection), uterus placental insufficiency, oligohydramnios and umbilical cord compression, among the most important ones. However, approximately, 75% of infants born through MSAF are vigorous at birth.

The most feared consequence of MSAF is the development of meconium aspiration syndrome (MAS). Around 3 to 12% of infants born through MSAF will develop MAS, the rate difference arising from different factors including among others: how is MAS defined, obstetric risk, and frequency of C-sections [2,3]. Though MAS is more frequent when the meconium is thick, around 17% of infants with MAS have developed it with thin meconium.

The clinical course of patients with MAS varies and can range from a mild respiratory difficulty to the most severe cases requiring mechanical assisted ventilation (30%), and some patients developing neurological complications and death (12%).

Thick meconium, abnormal foetal heart rate and need for resuscitation are the most commonly found-risk factors associated with MAS [6].

Over the years, questions related to MAS have varied: which is the physiopathology of MAS? When does meconium aspiration occur? In uterus, during delivery, or after birth?

Both the name of the syndrome and its definition suggest that the main problem associated with MAS is obstruction of the airway by meconium [7]. Yet, the mere aspiration of meconium does not produce the histologic and physiologic changes of severe meconium aspiration. Different physiopathologic mechanisms have been proposed to explain the syndrome: autopsies in stillbirths demonstrated in some cases the presence of meconium in the lower airway. Further, some other studies on animals and autopsies on infants dying from MAS in the first 48 h of life have shown histologic changes including hypertrophy of the pulmonary vasculature that must have taken several days to occur and suggest that asphyxia and pulmonary hypertension play an important role [8–12]. In summary it appears that MAS can either occur or begin prenatally.

Chemical pneumonitis, inflammation, infection, direct toxicity of type II pneumocytes, and surfactant inactivation by meconium are also aspects that have been implicated in the pathogenesis of MAS [7].

2. Are there prenatal measures to prevent aspiration?

Some obstetric practices have been used to decrease the risk of meconium aspiration. Neither the administration of opiates to the mother to prevent newborn gasping, nor the increase in the number of C-sections has been able to prevent MAS.

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A recent review article by Hofmeyr has found evidence that prolonged pregnancies, amniotomy during labour, and the use of uterine stimulants (mainly misoprostol) increase the incidence of MSAF and MAS [13]. As regards to amnioinfusion for dilution of meconium-stained amniotic fluid, a recent systematic review by Hofmeyr and Xu has concluded that only in settings with limited peripartum surveillance the procedure may decrease the number of C-sections, MAS, need for mechanical ventilation, hospitalization rates and perinatal mortality [14]. The data do not support, however, to propose the use of amnioinfusion for MSAF in settings with adequate obstetric care [15]. Further, there are some warnings against the use of amnioinfusion for its association with certain risks: umbilical cord prolapse, placental abruption, polyhydramnios and uterine overdistension and hypertonia with uterine rupture.

3. Intrapartum management: suction of the oro- and nasopharynx before the delivery of the shoulders

Until recently, the standard of care at birth of an infant with a history of MSAF included systematic oropharyngeal and nasopharyngeal suctioning before delivery of the shoulders, followed by tracheal aspiration regardless of consistency of meconium and clinical condition of the infant at birth [16]. Yet, the evidence supportive of this practice was essentially anecdotic: in 1976, Carson et al. published a small, not randomized study comparing 273 patients with MSAF using a combined therapy with intrapartum suctioning, laryngoscopy and intubation when meconium was observed below the vocal cords with historical controls without prenatal suction. The patients managed with this combined approach had a lower incidence of MAS (1 out of 273 [0.4%] vs. 18 out of 947 [1.9%]). Though the difference between the two groups was not significant ($p=0.071$), the authors concluded that with this approach, the patients presented less incidence of MAS [17].

Later on, Falciglia et al. compared 742 infants with MSAF receiving no intrapartum suctioning (the practice had not been adopted by then) with 755 newborns receiving oro- and nasopharyngeal suctioning. They found a similar incidence of MAS between the 2 groups (~2%) [18]. In a prospective observational study, the same author compared the infants who received prenatal suction with another group who received suction after delivery of the shoulders. Again, he could not find significant differences in MAS but there was a trend to higher frequency of air leaks in the suctioned group [19]. Moreover, the very low incidence of meconium aspiration communicated by Carson in infants suctioned before birth has not been found in other published series so far. Yet, prenatal suctioning has been adopted as a universal routine practice and has been included in the guidelines of the American College of Obstetricians and Gynaecologists (ACOG) and the American Academy of Pediatrics for almost 30 years [16]. Ensuing discussions focused only on the way prenatal suctioning was performed, as well as on the insertion depth, intensity of negative pressure and duration of the procedure.

Based on the little scientific support for prenatal suction and the new physiopathologic knowledge about the disease, we decided to re-evaluate the usefulness of the procedure.

We designed a large blind multicentre RCT which was performed in 11 hospitals in Argentina and 1 in the USA. 2514 term infants with MSAF were randomised to intrapartum suction (before the delivery of the shoulders) vs. no intrapartum suction. There were no significant differences between groups in the incidence of MAS (4% vs. 4%), need of MV, mortality or in the duration of MV, and oxygen therapy or hospitalization. No benefits of intrapartum suctioning on the same variables were detected when we analyzed the subpopulations at higher risk: thick meconium, foetal distress, need for resuscitation and caesarean section.

We concluded that intrapartum oro- and nasopharynx suctioning before delivery of the shoulders in infants born through MSAF does not prevent MAS or its complications [3]. Upon publication of the

results of this study, important scientific societies have changed their recommendations so that routine oro- and nasopharynx suctioning before delivery of the shoulders, regardless of consistency of meconium, is no longer recommended [20,21].

4. Delivery room postnatal interventions: endotracheal intubation and suction

Endotracheal intubation and suction in infants born through MSAF was first described by James in the 60s [22]. In 1974 Gregory et al. published a series of 88 infants born through MSAF within a cohort of 1000 consecutive infants born during a period of 6 months. Glottis visualization, endotracheal intubation and suctioning were performed in all infants. The authors observed that the disease was more severe when meconium was found below the vocal cords [23]. This finding in addition to the belief that the syndrome was caused by mechanical airway obstruction contributed to adopting intubation and endotracheal suctioning as standard of care for infants born through MSAF for more than 20 years.

Subsequent studies focused on finding the best strategy for clearing the airway [24]. In 1998, Linder et al. performed a non-randomized trial to evaluate the effect of intubation and suction on 572 vigorous infants delivered vaginally with MSAF. Tracheal suction did not decrease the incidence of MAS and some complications were related to intubation of vigorous infants in the delivery room [25]. After this study was published, there was a tendency towards a more selective management in the intubation of infants born with MSAF.

By late 90s, Wiswell et al. performed a large international RCT which evaluated the need for intubation of term vigorous infants born through MSAF regardless of consistency. 2094 newborns were randomized to endotracheal suction vs. expectant management. The study failed to show any intubation and post natal suctioning associated benefit in vigorous newborns [2].

Following the publication of these results, the Neonatal Resuscitation Program of the AAP and ILCOR modified the guidelines: intrapartum suctioning as well as postnatal endotracheal suctioning of vigorous infants with MSAF are no longer recommended [26].

To date, there has not been any randomized study evaluating immediate intubation and suctioning in depressed newborns.

In October 2010, ILCOR modified the recommendation to intubate and to suction depressed infants born through MSAF. The new recommendation states that: "The available evidence does not support or refute the routine endotracheal suctioning of depressed infants born through meconium-stained amniotic fluid" [27].

5. Other dangerous procedures in the delivery room

Other procedures have been recommended over the years: to place a finger in the mouth, to compress the chest or to perform external tracheal compression to prevent the infant from breathing, gastric lavage to prevent vomiting and aspiration, systematic exposure and visualization of the glottis to suction meconium when present at the level of the vocal cords [25,28]. All these techniques have not demonstrated benefits, rather, they have implicated potential risks, and therefore they cannot be recommended.

6. Which is the rate of adherence to the recommendations of neonatal resuscitation guidelines?

Currently, in spite of evidence and recommendations against the routine use of the practice, some authors still believe that hypopharynx suctioning before birth prevents or decreases incidence of MAS; therefore, they continue indicating its practice mainly in populations with deficient perinatal care [29]. However, prenatal suctioning could be dangerous with potential risks associated to its implementation such as apneas, vagal reflex bradycardia, delay in resuscitation and damage of

the palate or pharynx, among others. Routine suctioning might cause more harm than benefits, and we strongly believe that it should not be recommended [30].

Recent surveys, in Argentina and France about common practices in the delivery room when an infant is born through MSAF have shown a great diversity of actions among the different maternities. Overall, results have demonstrated that endotracheal and intrapartum suctioning, as well as other procedures (thorax or airway compression to prevent breathing, gastric lavage, etc.) are still being implemented in many institutions [31–33]. The Argentinean survey has shown that in some cases the decision to intubate/suction still depends on consistency of meconium which is not supported by literature.

This confirms the wide gap existing between evidence, guidelines and clinical practice [31]. Clearly, changes take a long time to take place despite strong evidence to do so.

7. Conclusions

Evidence based medicine has shown that none of the commonly implemented procedures in the delivery room in infants born through MSAF (amniocentesis and intrapartum or post delivery suctioning) is effective or useful to decrease or prevent MAS. Each of these procedures carries a potential risk and should not be performed as routine practices in pregnancies with MSAF. In view of the arguments presented, we suggest a change in the name of this pathology; it seems more appropriate to change MAS for *respiratory distress syndrome associated to MSAF*.

Conflict of Interest statement

The authors have no conflicts of interest in relationship to this article.

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