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Best practice guidelines

Consequences of meconium stained amniotic fluid: What does the evidence tell us?

Eileen K. Hutton [a,b,c,*], Julia Thorpe [c,1]

[a] Department of Obstetrics and Gynecology, Faculty of Health Sciences, McMaster University, Hamilton, Ontario, Canada
[b] Department of Midwifery Science, EMGO Institute for Health and Care Research, VU University Medical Center, VU University, Amsterdam, The Netherlands
[c] Midwifery Education Program, Faculty of Health Sciences, McMaster University, 1280 Main Street West, MDCL 2210, Hamilton, Ontario L8S 4 K1, Canada

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ABSTRACT

Background: Meconium stained amniotic fluid (MSAF) is common and associated with meconium aspiration syndrome (MAS). Other consequences of meconium passage before birth are less well understood.
Methods: We reviewed the literature for original papers reporting on outcomes associated with MSAF.
Findings: Among preterm infants MSAF is more prevalent than previously believed and is associated with higher neonatal morbidity. Intrauterine exposure to meconium is associated with inflammation of tissues of the lung, chorionic plate and umbilical vessels and through various mechanisms may contribute to neonatal morbidity, independent of MAS. No compelling evidence supported an association between MSAF and increased neurological impairment, including early seizure activity.

Contents

* Corresponding author at: McMaster University, 1280 Main Street West, MDCL 2210, Hamilton, Ontario L8S 4K1, Canada. Tel.: +1 905 525 9140x26654; fax: +1 905 523 6459.
E-mail addresses: huttone@mcmaster.ca (E.K. Hutton), jthorpe@mcmaster.ca (J. Thorpe).
[1] Tel.: +1 905 525 9140x22146; fax: +1 905 523 6459.

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1. Introduction

The presence of meconium in the amniotic fluid at birth is a common event which has been estimated to occur in up to 5% prior to 37 weeks' gestation, 25% of births at term and 23–52% among post-term gestations; [1,2] however the significance of meconium stained amniotic fluid (MSAF) is not understood. As a result of MSAF in the lung, an event that may occur before, during or after the birth, a small number of infants, about 5% of those exposed, will suffer the complications of meconium aspiration syndrome (MAS) [3,4]. Aside from the recognised complications for the neonate associated with MAS, the implications of MSAF have long been debated and much research has occurred in attempts to understand the importance of its presence. As a result, guidelines for management of labour in the presence of MSAF and of neonates exposed to MSAF have undergone many changes over the years. For example, the most recent evidence based [5] guidelines have shifted care from active suctioning of all neonates born through MSAF to expectant management for vigorous neonates born through MSAF [6,7].

It is likely that in many cases MSAF is a normal physiological phenomenon resulting from maturation of the foetus but that in some cases meconium stained liquor is a result of foetal stress. Irrespective of the cause for passage of meconium, in this paper we report on our review of the literature for proven consequences of MSAF.

2. Methods

We undertook a search of the literature on July 22, 2013 using MEDLINE (starting in 1946), EMBASE (starting in 1980) and CINAHL (starting in 1980). The search was not restricted by language. We used both the Medical Subject Heading (MeSH) terms and key words to search for meconium, meconium stained amniotic fluid, or meconium aspiration. In order to limit the search, we excluded MeSH terms for conditions that we determined a priori to be unrelated to this review. These included: cystic fibrosis, Hirschsprung disease, meconium ileus and substance-related disorders in pregnancy. We included articles that reported on a health outcome that was hypothesised to be a consequence of MSAF. We excluded articles where MSAF was described as an outcome rather than exposure, where meconium was the sample used for a biochemical test and where the focus was prevention or treatment of MAS.

3. Results of search

After screening the titles of 4451 articles found in our initial search, 780 remained. The abstracts were reviewed, resulting in 219 articles to be reviewed in greater detail. Some of these were reviews (n = 29), case reports (n = 19), clinical guidelines (n = 17), descriptive (n = 5) or reported only on the consequences of MAS (n = 33). These were included only as needed for background information. The remaining 116 papers were reviewed in detail.

Our search resulted in a broad range of possible outcomes that had been studied with regard to MSAF; some reported positive findings, some negative and many study findings are conflicting. We do not include papers that reported on outcomes associated with MAS. We will report on outcomes among preterm and full term gestations and maternal outcomes separately because there may be different aetiologies. We found a large number of papers that reported on outcomes associated with MSAF among full term low risk pregnancies. Some of these papers reported on general obstetrical outcomes, and others were focused on very specific outcomes such as prevalence of cerebral palsy (CP), colic and dermatological problems. We will report on the outcomes according to broad classification of: inflammation, infection, or asphyxia. We have included information about the hypothesised mechanism of action, if one has been proposed and summarise the findings within each section.

4. Consequences: foetal and neonatal — MSAF prior to term gestation

Although MSAF is generally considered to be a situation encountered in the term and post-term foetal population, approximately 5% of pregnancies <37 weeks' gestation will present with MSAF [1,2]. The first fatal case of MAS in a preterm infant was reported from the USA in 1993 [8]. Since then, five studies reported on outcomes of preterm labour complicated with MSAF [1,2,9–11] in populations of vertex, singleton, non-anomalous pregnancies. Using a nested case–control study, Mazor et al. matched 45 women with MSAF and 135 with clear fluid as evaluated at amniocentesis for gestational age at admission for preterm labour [9]. Among those with MSAF, they found significantly higher proportions of positive amniotic fluid cultures for microorganisms (38 vs 11%, $p < 0.001$), clinical chorioamnionitis (22 vs 6%, $p = 0.003$) and preterm birth (73 vs 41%, $p < 0.001$). A second study by this group used a single centre cohort study design with 4872 preterm births including 275 (5.7%) with MSAF, to undertake logistic regression and multivariate modelling and investigate relationships of MSAF with perinatal complications and maternal outcomes [1]. They reported that MSAF was an independent risk factor for death (Odds ratio [OR]: 1.73, 95% Confidence Interval [CI]: 1.06–2.54, $p = 0.001$) or other perinatal complications defined as: 1 minute Apgar < 3; 5 minute Apgar < 7; or small for gestational age (SGA) (OR: 2.35, 95% CI: 1.34–4.12, $p = 0.002$). Foetal or neonatal death was higher for the whole MSAF group, as well as for subgroups of 28–31 and 32–36 weeks' gestation. Maternal morbidity was not found to be different in the presence of MSAF. A much smaller Canadian study, reported a similar prevalence of MSAF (25/506 preterm births; 4.8%). They found no neonatal deaths; no differences in umbilical cord pH levels or in base excess among infants exposed to MSAF, and mean Apgar scores that were statistically significantly lower at 1 min (6.0 vs. 7.2 $p = 0.01$) and 5 min (7.7 vs. 8.4; $p = 0.01$). The authors did not consider the Apgar differences to be clinically important, however they found that more infants in the MSAF group were admitted to the NICU (75 vs 53%; $p = 0.04$) which might refute that opinion [2]. A case control study considered the relationship of MSAF in very preterm births (<33 weeks), in terms of adverse outcomes and the likelihood of exposure to Listeriosis compared to controls of the same gestational age born with clear AF. The study found no cases of Listeriosis, no differences in mortality, Apgar score, or cord pH between cases and controls. Grades 3–4 intraventricular haemorrhage (IVH) occurred more commonly with MSAF (OR: 2.03, 95% CI: 1.62–2.53) [10]. An Italian study also reported on pregnancies <33 weeks gestation and using logistic regression analyses found that MSAF increased the odds for cerebral palsy (CP) (OR: 4.36, 95% CI: 1.69–11.2) and for CP and death (OR: 3.83, 95% CI: 1.33–11.05) [12]. A paper by Wong reported outcomes by subgroups according to gestational age, including a small number of pregnancies <37 weeks (38 MSAF, 592 clear AF). They found no differences in non-reassuring cardiotocograph in this population (7.9 vs 8.6%; OR 1.00) [13].

Henry et al. used microscopic techniques to more accurately determine the presence of meconium on 431 placental samples from infants born at <1350 g who survived >24 h [11]. They report that the prevalence of meconium passage in this population of very low birth weight (VLBW) infants is likely to be much higher (16%) than what has been reported based on gross observation. This study reported infants exposed to meconium, that was determined using microscopic categorisation, were more likely to be born by Caesarean section (69 vs 51% $p = 0.006$); to have evidence of chorioamnionitis, both histological (50 vs. 36% $p = 0.024$) and clinical (26 vs 16%, $p = 0.045$); experience Grades 3–4 IVH (13 vs. 5%, $p = 0.011$) and bronchopulmonary dysplasia (BPD) or death (61 vs. 45%, $p = 0.011$). Infants in the MSAF group were also more likely to experience all types of resuscitation at birth (intubation, chest compression, volume resuscitation) and to have a lower 5-minute Apgar score.