International Journal of Clinical Obstetrics and Gynaecology

ISSN (P): 2522-6614
ISSN (E): 2522-6622

www.gynaecologyjournal.com
2020; 4(2): 157-160
Received: 23-01-2020
Accepted: 26-02-2020

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# Risk factors of meconium stained amniotic fluid-a case control study

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**DOI:** https://doi.org/10.33545/gynae.2020.v4.i2c.521

**Abstract**
**Aim of Study:** To find out the risk factors (both maternal and fetal) in causing meconium stained amniotic fluid in women in labour at SAT Hospital, Trivandrum.
**Methodology:** Our study is a case-control study with cases: controls = 1:2. Our sample size =351; cases =117 and control=234. CASES include women with gestational age ≥37 weeks in labour with meconium stained liquor which is assessed by looking at the colour of liquor at the time of rupture of membranes or after rupture of membranes, Controls include women with gestational age ≥ 37 weeks in labour with clear liquor at the time of rupture of membranes till delivery.
**Results:** In our study, we found out that the risk factors for meconium stained liquor were gestational age ≥ 40 weeks, ante-natal check-ups <3, maternal disease like anaemia, hypothyroidism, gestational diabetes, maternal infections like vaginitis, UTI, LRTI, fetal factors like IUGR, cord around neck at the time of birth. In my study, thick meconium is seen in 20.7% cases. Meconium aspiration syndrome was seen in 30% babies admitted to NICU.
**Conclusion:** Maternal conditions like hypothyroidism and anaemia should be treated in women of reproductive group before conceiving. During our ante-natal check-ups IUGR and liquor volume should be detected. Gestational age more than 40 weeks was associated with MSAF and delaying induction till 42 weeks may increase the risk of meconium stained liquor. Maternal infections like vaginitis, UTI, LRTI should be treated at the earliest. Risk factors like gestational diabetes, anaemia hypothyroidism, IUGR and oligaminos were associated with thick MSAF and meconium aspiration syndrome.

**Keywords:** Meconium stained, amniotic fluid, risk factors

## Introduction
The term Meconium is derived from Greek word 'Mekonion' a word for Opium /Poppy Juice Aristotle coined the term Meconium and reported opium like effects in neonates born through Meconium stained amniotic fluid. Meconium is the first intestinal secretion from fetus. It starts as early as ten weeks of gestation and incidence of intra-uterine passage of Meconium increases with the gestational age. Meconium is sterile material produced by fetal digestive tract. It is composed of material ingested by fetus from amniotic cavity such as epithelial cellS, lanugo, blood, amniotic fluid and is pigmented by bile. The majority of fetus will not pass meconium in utero. A minority of foetuses pass meconium in utero resulting in amniotic fluid stained with meconium. Obstetric Convention grade meconium as:
Grade 1: describes large volume of amniotic fluid lightly stained with meconium.
Grade 2: describes a good volume of amniotic fluid heavily stained with meconium.
Grade 3: describes absent or reduced volume of amniotic fluid so that meconium is very thick.
The terms light, moderate and thick are equally acceptable.

## Epidemiology
Meconium stained liquor contributes 8 -20% of all births after 34 weeks. The incidence increases with gestation with an incidence of more than 30% after 42 weeks. Conversely incidence is low in gestation below 34 weeks with an incidence less than 5%.
In our Hospital, during the year 2015 there were about 420 cases of meconium stained liquor which constitute about 6 %.

## Methodology
**Study Design:** Case – control study
**Study Setting:** Labour room of SAT Hospital, Trivandrum

**Study Population:** All women admitted in labour room of SAT Hospital, Trivandrum.

**Cases:** include women with gestational age > 37 weeks in labour with meconium stained liquor which is assessed by looking at the colour of liquor at the time of rupture of membranes or after rupture of membranes.

**Controls:** include women with gestational age >37 weeks in labour with clear liquor at the time of rupture of membranes till delivery.

**Exclusion criteria**

1. Multiple pregnancy
2. Non – vertex presentation
3. Gestational age < 37 weeks
4. Intra uterine demise

**Sample size**

N=(R+1)/R *(P(1-P)*(Zb+Za/2)^2/(P1-P2)^2)
Where N =sample size in case group,R= ratio of controls to cases,
Zb=desired power (typically 0.84 for 80% power
Za/2=desired power of statistical significance typically 1.96
P1-P2= effect size (the difference in proportions); P= a measure of variability (similar to standard deviation)
In our study, cases: controls = 1:2, using a equation, my sample size =351; cases =117 and control=234

**Values are taken from following study**

**Maternal And Fetal Characteristic With Meconium Stained Liqour:** Balchin, Whittaker, where P is the incidence of meconium stained liquor in South Asians with Gestational age more than 37 weeks and it is 16.8%.

**Data Collection Tool**

An interview schedule was used to collect the information regarding maternal age, parity, maternal comorbidities, nature of labour, if induced type of induction agent, partogram was used to know the duration of labour, obstetric usg in third trimester to assess the liquor volume, fetal growth and Doppler. Per speculum examination to detect vaginal infections. Auscultation of chest to find LRTI.

**Data Collection Technique**

Cases were be patients with gestational age more than 37 weeks in labour with meconium stained liquor at the time of rupture or after that. Controls were patients with gestational age more than 37 weeks with clear liquor at the time of rupture of membranes till delivery. Controls were selected from patients with clear liquor which comes before and after meconium stained liquor in labour register.

**Results**

**Risk Factors of Meconium Stained Amniotic Fluid**

Age Higher incidence of meconium staining was seen in age group 20-30 years (78.6%). 20-30 years corresponds to age group with highest reproductive potential. Out of 351 study population 75.5 % belong to the age between 20-30 years. Age was not statistically significant risk factor in meconium stained liquor according to my study. The mean age of cases was 25.14 years and mean age of controls was 25.9 years. Case and controls were properly matched for age.

**Socio-Economic Status:** Socio-economic status assessed using modified Kuppuswamy classification taking into consideration education and occupation of head of the family and income. It was classified as lower class when the score was 0-10, middle when the score was 11-25, upper when score was 26-29. Among the cases 66.7% belong to middle class and 73.5 % of controls belong to middle class. No statistical relation was seen between MSAF and socio-economic status.

**Parity:** In our study 64.1% of cases were primigravida and 66.7 % of controls were primigravida. In our study meconium is seen commonly in primigravida. Parity was not statistically significant.

**Gestational Age:** MSAF was seen in 24.8% of the cases who are ≥ 40 weeks of gestation. It was found out to be statistically significant with an OR =2.64, 95 % CI (1.47-4.73). In our SAT Hospital, our protocol is to induce the patient 1 day after her expected date of confinement if she does not get into labour. We won't wait till 42 weeks for spontaneous onset of labour. Out of the 55 patients who were ≥40 weeks, 29 had meconium staining of liquor which was about 52.7%. 11.1% of controls belong to gestational age ≥40 weeks.

**Fever with rash in first trimester:** Patients with high grade fever >38.9 degree Celsius for more than 24 hours and associated with rash over the body during first three months of ante-natal period was taken as a risk factor. Out of the 117 cases, 12 cases had fever with rash in first trimester which constitute 10.3%. It was found to be statistically significant with an OR of 3.71 with a 95 % CI =1.42 -9.68.

**Gestational Diabetes:** Out of the 113 GDM patients, 52 patients had meconium stained which constitute 46.01 %.Relation between GDM and MSAF was found to be statistically significant. In my study population none of the subjects are overt diabetic. Out of the 117 cases of meconium stained liquor, 52 had GDM which was about 44.4%.OR of the study was 2.27 with 95 % CI =1.42-3.62.

**Gestational Hypertension:** In our study population, 37 patients had GHTN (10.54%), of which 13 had MSAF and remaining 24 had clear liquor at the time of delivery. Of the 117 cases of MSAF, 13 had GHTN which was about 11.1%. Gestational hypertension was not statistically significant. In my study, none of the subjects had chronic hypertension.

**Thyroid Disease:** Out of the 117 cases of MSAF, 54 cases had hypothyroidism which was about 46.2%. Out of the 234 controls, 25 had hypothyroidism which was 10.7%.Thus presence of hypothyroidism was found to be statistically significant. OR was 7.17 with a 95% CI =4.13-12.44. In our study population none of the cases had hyperthyroidism. 22.5% study population had hypothyroidism.

**Anaemia:** In our study population 25.35% had anaemia.74.15 % had mild anaemia, 24.71% had moderate anaemia, 1.1% had severe anaemia. In our study, we found statistically significant relation between anaemia and MSAF. Out of the 351 study population 89 subjects hadanaemia. Out of the 89 anaemic subjects, 51 had meconium staining of liquor. Of the 117 cases of MSAF, 51 had anaemia which was about 43.6%. OR =3.99 with a 95% CI=2.41-6.60.

**IUGR:** In our study population 12% have IUGR. Presence of IUGR was statistically significant in causing meconium stained

liquor. Out of 117 cases of MSAF, 31 cases had IUGR which was 26.5%. Of the 234 controls, 11 had IUGR which was 4.7%. OR of the study was 7.31 with a 95% CI =3.52-15.19.

**Cord Around Neck:** Cord around the neck at the time of delivery was found to be statistically significant. Out of the 117 cases, 57 had cord around neck at the time of delivery which was about 48.7%. Of the 234 controls, only 5 had cord around neck at the time of delivery. OR of the study was 43.51 with 95% CI=16.70-113.33.

**Amount of Liqour:** Oligamnios was seen in 12.82% study population and polyhydraminos seen in 5.69% of study population.In my study, amount of liquor <5 has been found to be associated with MSAF. Of the 117 cases of MSAF, 23 cases have meconium staining of liquor which is about 19.7%.It was found to be statistically significant.

**Maternal Vaginitis at Term:** In our study maternal vaginal infections at term was found to be statistically significant factor in MSAF. 23.36 % of the study population had vaginal infections at term. Of the 82 cases of vaginal infection, 71 had meconium staining of liquor. It was found to be statistically significant. Of the 117 cases with meconium stained liquor, 71 had vaginitis which was about 60.7%.

**Maternal UTI at Term:** Maternal UTI at term was found to be statistically significant in causing meconium stained liquor. Out of the 351 subjects, 43 had UTI which was about 12.25%. of the 43 subjects with UTI, 37 had meconium staining of liquor. of the 117 cases of meconium stained liquor, 37 had UTI at term which is 31.6%. OR =17.58 with 95% CI=7.15-43.20.

**Maternal LRTI at Term:** In our study maternal LRTI at term was found to be statistically significant in causing meconium stained liquor. of the 351 subjects, 25 had LRTI at term which was about 7.1%. of the 25 subjects with LRTI 20 had meconium stained liquor. of the 117 cases of MSAF, 20 had LRTI at term which was about 17.1%.OR=9.44 with 95% CI=3.45-25.88.

**Antenatal Check–UPS** In our study ante-natal check- ups less than 3 was statistically significant in causing MSAF. In my study only 3 out of 351 patients had <3 antenatal visits. All the three had meconium stained liquor. Only 3 out of 351 subjects had less than 3 antenatal check-ups, this shows the efficacy of our antenatal care. Of the 117 cases of MSAF, 3 have < 3 antenatal check-ups.

**Prolonged Labour:** In our study out of 351 study population, 7 had prolonged labour of which 6 had meconium stained liquor. In our study, prolonged labour had statistically significant relation with MSAF. Of the 117 cases of MSAF, 6 had prolonged labour which is about 5.1%.

**Risk factors of thick meconium stained liqour**

Out of the 117 cases of meconium staining of liquor, 35 was light meconium stained liquor (30.2%), 57 moderate stained (49.1%) and 24 thick meconium stained (20.7%).

Thick meconium is seen in 24 cases of which 18 cases were seen in age group between 20-30 years. This is because 20-30 years is the common reproductive age group in our SAT Hospital. Of the 24 cases of thick meconium, 16 were primigravida which is about 66.7%. Anaemia is seen only in 12 cases of thick meconium stained liquor (total is 24 cases).Of which 7 had mild anaemia (Hb 10-10.9gm%) and 5 had moderate anaemia (Hb 7-10 gm%). Of the 24 cases of thick meconium, 6 cases were induced and 18 had spontaneous onset of labour which is 75 %.Of the 24 cases of thick meconium, 17 cases had liquor volume between 5-24 which is about 70.8%. Gestational diabetes was seen in 10 cases of thick meconium which was about 41.7%. Thyroid disease that is hypothyroidism was seen in 11 cases of thick meconium which was about 45.8%. Anaemia was seen in 12 cases which was 50 % of which 7 were mild anaemia and 5 moderate anaemia. IUGR (b.wt <2.5 Kg) was seen in 10 cases of thick meconium stained liquor which was 41.7%. Cord around neck at the time of delivery of the baby was seen in 17 cases which was about 70.8 %. Maternal vaginitis at term was seen in 14 cases which was about 58.3%. Out of the 24 thick meconium cases, 20 delivered vaginally (83.3%) and 4 had LSCS.

**Factors causing meconium aspiration syndrome**

Out of the 117 cases of meconium stained liquor, 13 had neonatal distress which is about 11.1%.Neonates with APGAR less than 5 at 1 min and 7 at 5 min is considered as having neonatal distress. Out of 117 cases of meconium stained liquor, 82 were admitted in NICU which is about 70.1%. Of the 82 babies admitted in NICU, 24 developed meconium aspiration syndrome which is about 30 %. Of the 117 cases of meconium stained liquor, 24 developed meconium aspiration syndrome. Of the 24 babies with MAS, 20 were born to mother's with age group between 20-30 years which was 83.3%. This is the most common reproductive age group.

Out of the 24 cases of MAS, 13 mother's had vaginitis at term (54.2%). 13 babies were born with cord around neck which is 54.2%.12 mothers had GDM and hypothyroidism which is about 50%.9 babies were IUGR (37.5%) and 9 mothers had UTI at term (37.5%). 11 mothers had anaemia (45.8%). Of the 24 cases with MAS, 11 had anaemia (45.8%). Out of the 11, 6 had mild anaemiaand 5 had moderate anaemia. Of the 24 cases of MAS, 20 had spontaneous onset of labour and only 4 were induced (16.7%). Of the 4 induced cases whose babies developed MAS, 2 induced with PGE1, 1 with PGE2 and 1 foleys. Of the 24 babies,9 babies had birth weight less than 2.5 kg (37.5%).14 cases had birth weight between 2.5 -3.5 kg (58.3%). Of the 24 cases, 17 had vaginal delivery (70.8%) and 7 had LSCS which is 29.2%.

**Discussions**

High incidence of MSAF is seen in age group 20-30 years. It corresponds to age group with highest reproductive potential. 78.6% cases and 73.9 % controls belonged to the age group between 20-30 year. In our study owing to low prevalence of pregnancy in extremes of age, maternal age was not statistically significant. In our study socio-economic status and MSAF were not statistically significant. 64.7% cases and 73.5% controls belong to middle socio-economic class in my study. This shows the improved condition of people in Kerala when compared to other states. In the data analysis it was seen that MSAF is seen more commonly in primigravida. But it was not found statistically significant. 64.1% cases and 66.7% controls were primigravida. In our study, gestational age ≥ 40 weeks was found to be statistically significant. 52.7 % of patients ≥40 weeks had meconium stained liquor. 24.8% cases were ≥ 40 weeks and 11.1%controls were ≥ 40 weeks. In our study, fever in first trimester was found to be statistically significant. 10.3% cases had fever with rash in first trimester. In first trimester fever with rash could compromise the foetus and might subject the foetus to hypoxia during late stages of labour. In our study, GDM was found to be statistically significant. In GDM,

evidence support the role of reactive oxygen species in pathogenesis of placental insufficiency and other pregnancy complications. In our study, GHTN was not statistically significant. It could be because our SAT Hospital, Trivandrum is a tertiary care centre, where most of the GHTN patients will be on more than one antihypertensives and full trial of labor not given. In our study, thyroid disease and anaemia were statistically significant. 26.5% cases of MSAF had IUGR. It was statistically significant. As the fetus is growth retarded there is more chance of hypoxia during labour which results in meconium staining of liquor. In our study, cord around neck at the time of delivery shows a significant relation with MSAF. At the time of delivery, cord around neck may cause hypoxia which results in passage of meconium. In our study cord around neck was seen in 48.7% cases. Oligaminos (liquor less than 5) was considered as statistically significant. Liqour less than 5 might cause cord compression and fetal hypoxia during labour hence result in meconium staining of liquor. In our study, 19.7% cases had liquor less than 5. In our study, maternal infections at term like vaginitis, LRTI, UTI was found to be statistically significant. The reason may be ascending infection may cause infection of placenta and amniotic membrane causing fetal asphyxia. In our study, < 3 antenatal check ups was statistically significant in causing meconium stained liquor. Out of the 351 subjects only 3 had less than 3 ANCs. Because of lack of antenatal check-ups lead to unidentification of risk factors causing meconium stained liquor. Birth weight of babies was found to be statistically significant. Meconium staining of liquor is more commonly seen among babies with birth weight <2.5 kg. This is because low birth weight of babies is associated with maternal gestational hypertension, maternal anaemia, maternal infections, irregular ante-natal check-ups. Low birth weight may lead to hypoxia during labour causing meconium staining of liquor.

**Conclusion**

In my study, gestational age > 40 weeks was found to be significantly associated with meconium stained liquor, hence delaying induction till 42 weeks may increase the risk of meconium stained liqour. Maternal conditions like anaemia and hypothyroidism is significantly associated with MSAF. Hence we should aim at treating anaemia and hypothyroidism in adolescent girls and women of reproductive age group before conceiving. During our antenatal check ups we should detect IUGR and liquor volume while palpating abdomen and detect high risk individuals who can develop fetal growth restriction. Maternal infections at term like vaginitis, UTI and LRTI are risk factors of MSAF. We should detect infections like UTI and vaginitis at the earliest and treat them. We should put a partogram to assess whether the labour is progressing at the required rate and detect prolonged labour at the earliest as prolonged labour is a risk factor for MSAF. While handling patients with risk factors like gestational diabetes, anaemia, hypothyroidism, IUGR, oligaminos in labour room, we should be cautious as they are at high risk of having thick meconium stained liquor and meconium aspiration syndrome for the baby.

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