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Study of Meconium Aspiration Syndrome of Lung in Neonatal Autopsies at a Tertiary Care Centre

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Abstract: **Background:** Autopsy as a word means self-study of dead body. The importance of lung diseases in Pathology and Clinical Medicine is well known. Aspiration of amniotic fluid with meconium represents one of the cause of perinatal mortality. Meconium aspiration syndrome (MAS) described as respiratory distress in an infant born through meconium-stained amniotic fluid whose signs cannot be otherwise explained. **Aim:** To know the prevalence of MAS in the neonates dying within 24 to 48 hours of admission and with unknown cause of death. **Materials and Methods:** Present was a retrospective, non- interventional and cross section study conducted at Department of Histopathology and Pediatrics at a Tertiary Care Center, from July 2018 to June 2020. Total 42 cases of MAS (Medico-legal) were included. **Results:** Out of the total 520 autopsy cases, 42 cases (8.08%) showed MAS as the cause of death. 32 neonatal deaths were within 24 hours of birth (76%) and 10 neonatal deaths were within 48 hours of birth (24%). Male to female ratio was found to be 2.5: 1 with male preponderance. **Conclusion:** The histopathological diagnosis of MAS on neonatal autopsy correlates well with clinical cause of death.

Keywords: Meconium Aspiration Syndrome, Neonates, Autopsy, Lung, Histopathology.

INTRODUCTION

Autopsy as a word means self-study of dead body. It is an important way to find out the condition of internal organs, to evaluate disease or injury that could explain the cause and manner of a person's death. Examination of all the three cavities of body including cranium, thorax and abdomen are an essential part of autopsies. In thorax, lung examination is the most important part of both the medicolegal as well as clinical autopsies.[1] The Clinical autopsy or Pathological autopsy is usually performed by Pathologist to establish the cause of death and to study the disease process which led to death[2]. The Medicolegal autopsy is carried out by Forensic expert to help the law to establish identity, cause of death, time of death, and ante-mortem or post-mortem nature of crime[1]. Here consent from relatives may not be required. An autopsy includes detailed external examination and dissection of organs from cranial, thoracic, abdominal and pelvic organs. These findings are further correlated and confirmed by Histopathologist after microscopic examination of paraffin sections. Final cause of death is given by Forensic expert only after correlation with Histopathological opinion. Thus, autopsy is a major guide to opine about the cause/ manner of death in both Clinical and Medicolegal autopsies[3].

The importance of lung diseases in Pathology and Clinical Medicine is well known.[3] However, despite pitfalls like delay in carrying out autopsies, improper sampling, improper preservation and transport, microscopic examination of tissues is still considered a gold standard method to study the disease process in situ, thus enriching the medical knowledge.[1] Autopsy, once an integral part of medical practice is now infrequently performed. Recent estimates place the autopsy rate at only 15%, down from a peak of 50% in the years following World War II. For the Obstetrician, Paediatrician, and parents, the anticipated outcome of pregnancy is birth of a healthy baby and the possibility of perinatal death is not expected at any level.[4]

Aspiration of amniotic fluid with meconium represents one of the cause of perinatal mortality. The frequency of meconium presence in amniotic fluid is 5 - 22%, the aspiration of amniotic fluid occurs in around 10 – 15 % new-borns, where 2 - 10 % of them develop meconium aspiration syndrome.[5,6,7,8] Meconium aspiration syndrome (MAS) has been defined by clinical criteria: (1) respiratory distress (tachypnoea, retractions or grunting) in a neonate born through meconium-stained amniotic fluid (MSAF); (2) a need for supplemental oxygen to maintain oxygen saturation of haemoglobin (SpO_2) at 92% or more; (3) oxygen requirements starting during the first 2 h of life and lasting for at least 12 h and (4) absence of congenital malformations of the airway, lung or heart.[9] Thus, it is described as respiratory distress in an infant born through MSAF whose signs cannot be otherwise explained.[7] The incidence of MSAF in all births was in the 1990s estimated to be within a wide range from 7 to 22% as reviewed by Katz and Bowes[10], MAS is 1 MSAF signifies underlying foetal hypoxia and is found in 10–15% of live births. About 2–9% of infants born through MSAF develop MAS. Globally, every year 2.6 million neonates die and three-fourths of these deaths occur in the first week of life.[7] Meconium consists of numerous substances of host origin mainly derived from the digestive tract, including salivary, gastric, pancreatic and intestinal juices, mucus, bile, bile acids, cellular debris, lanugo hairs, fetal wax and blood. Notably, since meconium is located 'extra-corporeally', like the whole content of the gastrointestinal tract, its constituents are hidden and normally not recognized by the fetal immune system. Normally, meconium is sterile as the colon is inoculated with bacteria after delivery. This is important with respect to the view of meconium as a potential danger to the fetus, containing

innumerable potentially endogenous signals that can be recognized as 'damaged self' by the immune system.[9] The first description of meconium aspiration and meconium aspiration syndrome dates back from 1918.[5]

The present study was carried out upon neonatal autopsy lung specimens, in order to know the prevalence of MAS in the neonates dying within 24 to 48 hours of admission and with unknown cause of death, at a Tertiary Care Centre over a period of two-years.

MATERIALS AND METHODS:

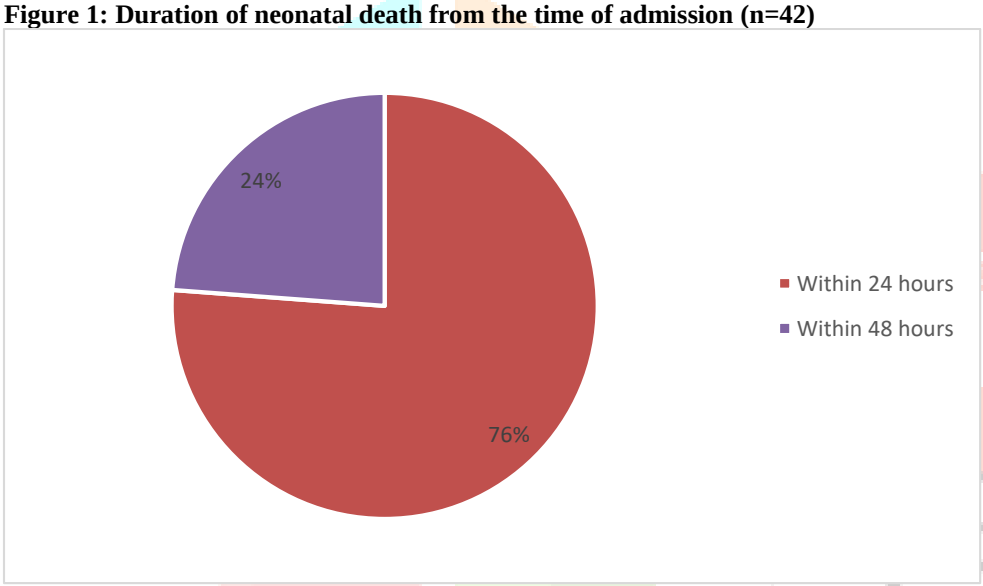
Present was a retrospective, non- interventional and cross section study conducted at Department of Histopathology and Pediatrics at a Tertiary Care Center over a period of two-years from July 2018 to June 2020. Retrospective data of 42 cases of MAS (Medico-legal) was collected from postmortem reports, where the cause of death was unknown and the babies died within 24 to 48 hours of admission. However, partial and completely autolyzed specimens were excluded. Ethical clearance was not taken because of medicolegal nature of cases. Detailed Medical and Clinical history was obtained from records. The lung pieces or whole lung received were weighed, dimensions were noted and fixed in 10% formalin. Floating test was performed. In gross examination, the organ was meticulously observed for color, consistency, nodules, infarcts, secretions, edema, granulomas, adhesions and abscess cavities. All pathological areas were adequately sampled. Paraffin blocks were made. 4-5 micron thin sections stained with Hematoxylin and Eosin (H&E) were studied in details. Special stains like Periodic Acid Schiff (PAS) was studies in every case to confirm nature of aspirated meconium.

RESULTS:

Out of the total 520 autopsy cases received over the study period, 80 (15.38%) were of neonatal deaths. Out of which, 42 cases (8.08%) showed MAS as the cause of death (52.5% of neonatal autopsy).

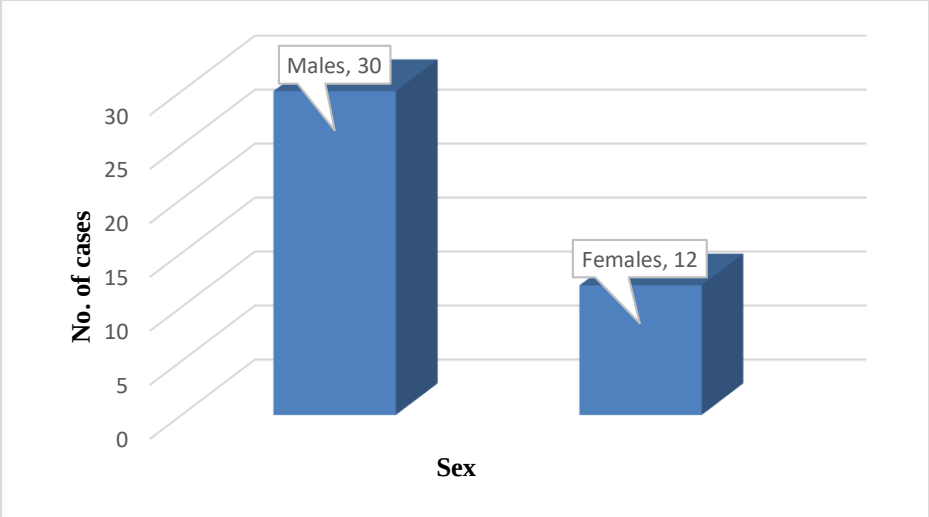
Among these 42 autopsy cases, 32 neonatal deaths were within 24 hours of birth (76%) and 10 neonatal deaths were within 48 hours of birth (24%). (Fig 1)

Figure 1: Duration of neonatal death from the time of admission (n=42)



Male to female ratio was found to be 2.5: 1 with male preponderance. The present study included total of 30 males (71.4%) and 12 females (28.6%). (Fig 2)

Figure 2: Sex-wise distribution of cases (n=42)



DISCUSSION:

The main cause of meconium aspiration is asphyxiation of the neonate leading to the release of meconium and gasping inspiration. Intra-uterine causes of asphyxiation are placental insufficiency, hypertension and diabetes mellitus of the mother, preeclampsia and eclampsia, amniotic fluid deficiency, use of abusive substances like tobacco, alcohol and cocaine by the mother, chorioamnionitis, and on the side of the neonate, lung hypoplasia or aplasia, respiratory system anomaly and anomalies of the diaphragm.[5] Pathophysiological mechanism that completely or partially closes the small airways with aspirated meconium explains the development of atelectasis or expansion of the alveolar space and emphysema. Meconium, however, may cause toxic damage of lung tissue, surfactant inactivation and inflammation.[11] Fetal pancreatic enzymes in the meconium may cause lung tissue digestion.

Meconium acts as a pro-inflammatory substance and stimulates production of interleukins (IL-1, IL-6, IL-8) which have chemotactic effect on inflammatory cells, neutrophils and macrophage. These may be found in alveoli, major airways and lung tissue of the new-borns with MAS secondary to bacterial infections of lung tissue (Pneumonia) with multiple organ damage.[5] MAS is a frequent cause of admission in neonatal departments. Neonates with MAS present at or just after delivery with marked respiratory distress and hypoxemia with X-Ray chest showing hyperinflation, patchy infiltrates and occasional air leaks. It is associated with multiple life threatening complications including hypoxic ischemic encephalopathy (HIE) (46%), hypotensive shock (22%), pneumothorax (11.4%), myocardial dysfunction (22%) and pulmonary hypertension (PHN) (17%).[12,13]

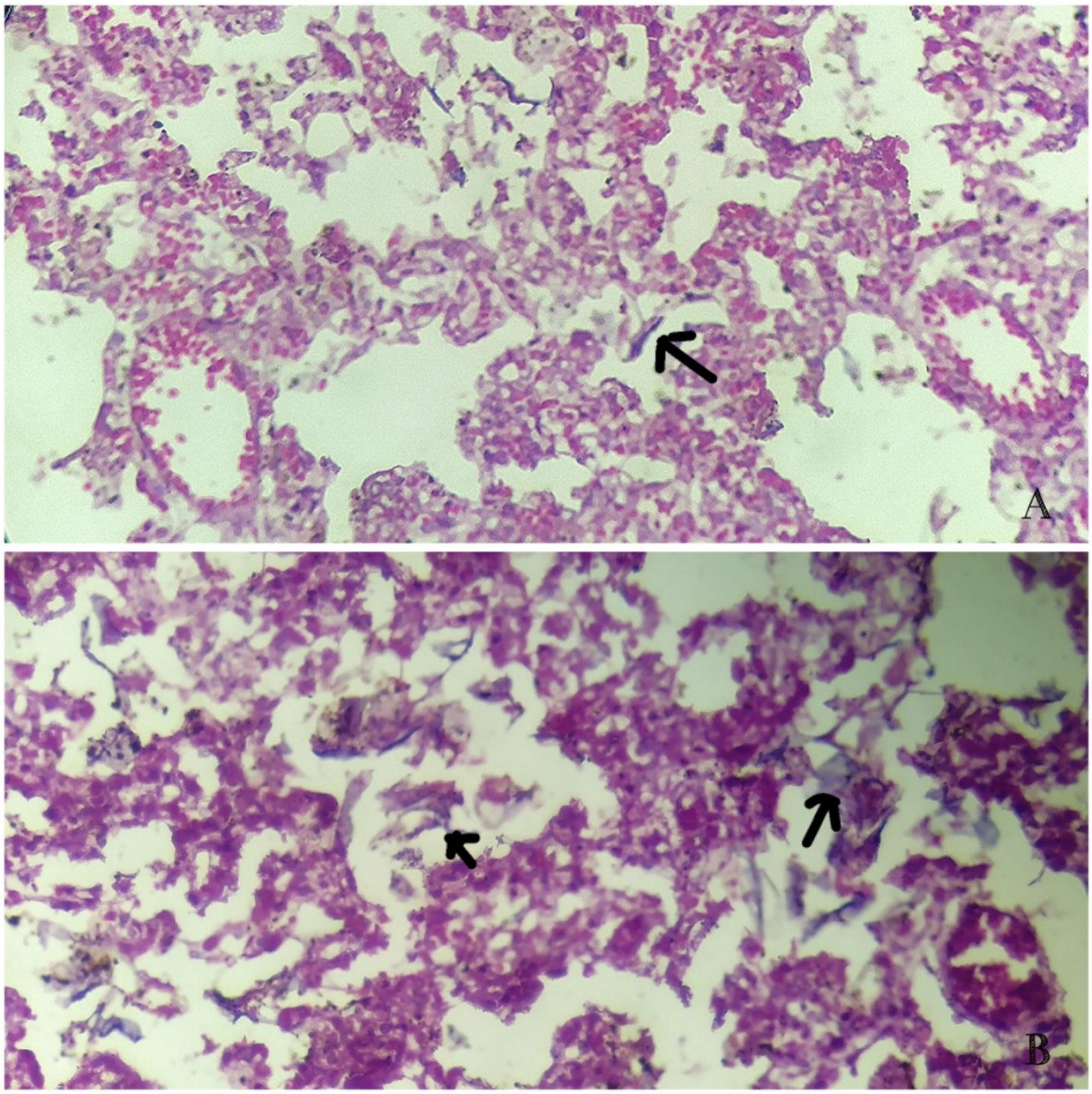
Thomas S et al., in their prospective study on spectrum of respiratory distress in 1400 consecutive new-borns in North Indian population found that 116 cases developed respiratory distress.[14] Among these 116 cases, there were 10 cases of hyaline membrane disease and 14 cases of meconium aspiration syndrome. However, the post-mortem correlation could not be done as in many cases autopsy was refused. The study established that HMD was a disease of preterm (all 10 cases were preterm) and MAS was seen mostly in term babies (11 out of 14 cases were term babies). Khare P et al[1] study reported one case of MAS. Marinković N and Aleksić[5] reported a case of Meconium aspiration.

The value of postmortem examination of neonates may be even more important than in older children and adults. This is because many neonates die shortly after birth, before diagnosis is clearly established.[4] Forensic problem of meconium aspiration is alarming, due to the increased risk of malpractice lawsuits in the event of death of a new-born due to meconium aspiration or its consequences.[5]

Treatment and therapy of the new-born with meconium aspiration have changed over the decades. The treatment of severe forms of MAS implies mechanical ventilation. Other than the mechanical ventilation, the therapy of choice includes antibiotics, corticosteroids and exogenous surfactants, since the secondary deficit of surfactant plays a significant role in the pathogenesis of MAS, and the corticosteroids act on inflammatory processes in case of MAS and may contribute to the synthesis of surfactant.[8]

The mortality of MAS in children born with MSAF has decreased over the years particularly in the developed countries, due to advances in medical health services.[7]

Figure 3: Microphotographs of Meconium Aspiration seen in lung tissue (H&E, 400x)



CONCLUSION:

The histopathological diagnosis of MAS on neonatal autopsy correlates well with clinical cause of death.

MAS complicated by Persistant Pulmonary Hypertension (PPHN) and chemical pneumonitis has worst outcome in terms of both longer hospital stay and higher mortality, followed by Pulmonary Hypertension (PHN) and Chemical pneumonitis alone. MAS, with the overall therapeutic treatment, in a certain number of new-borns may lead to death. As a preventive measure, pregnant women with high risk factors of hypoxic fetal distress should be monitored on a regular basis in antenatal (ANC) check-ups.

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