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Case Series

Gastric Aspiration in Infants As A Cause Of Death: Case Series

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Abstract

The rationale for this case series is the four cases seen by authors where gastric contents were seen in terminal bronchioles on autopsy. The fact that gastric aspiration is considered to be a post-mortem phenomenon (agonal regurgitation) and is also enlisted in ICD11 brings more dilemmas in forensic practitioners concerning the cause of death when this finding is seen in suspected cases. This article describes four case reports of aspiration deaths in infants, along with literature review, definitions, diagnosis, epidemiology, pathophysiology, and whether aspiration can be given as a cause of death in suspected cases.

1. Introduction

Sudden death due to its unexpected nature and death within one hour to twenty-four hours of the onset of terminal events is often met with suspicion both by the family and police. Gastro-intestinal cause of death accounts for less than ten percent of the cause of death. Gastric aspiration is defined as the inhalation of gastric contents into the airway or lower respiratory tract. It leads to a spectrum of features from acute lung injury to pulmonary edema to airway obstruction to chronic airway disease. Regurgitation on the other hand is the presence of stomach contents into the oropharynx or esophagus but not the lungs.[1,2]

PB04 deals with Unintentional threat to breathing by inhalation or ingestion of gastric contents.[3] The true incidence of gastric aspiration is not possible as most of the vents are unwitnessed. The incidence of gastric aspiration is one event in 89 patients.[4] We stick to the term gastric aspiration as it is mentioned in ICD11. Depending on the number of contents, a temporal relation of the regurgitation, host response, and predisposing conditions of the individual the aspiration elicit a varied response in an individual. It may vary from chemical injury to lung to bacterial infection to acute respiratory distress syndrome which may be fatal.[5] Gastric aspiration seen in upper airways is considered a post-mortem phenomenon or agonal. However, if the contents are seen in the terminal bronchioles, it may be antemortem.

2. Methodology

Four case reports were presented as case series and a literature review was done on the topic of pulmonary aspiration. We used search engines like PubMed, Google Scholar. Our keywords were pulmonary aspiration, infants, agonal aspiration, stomach contents.

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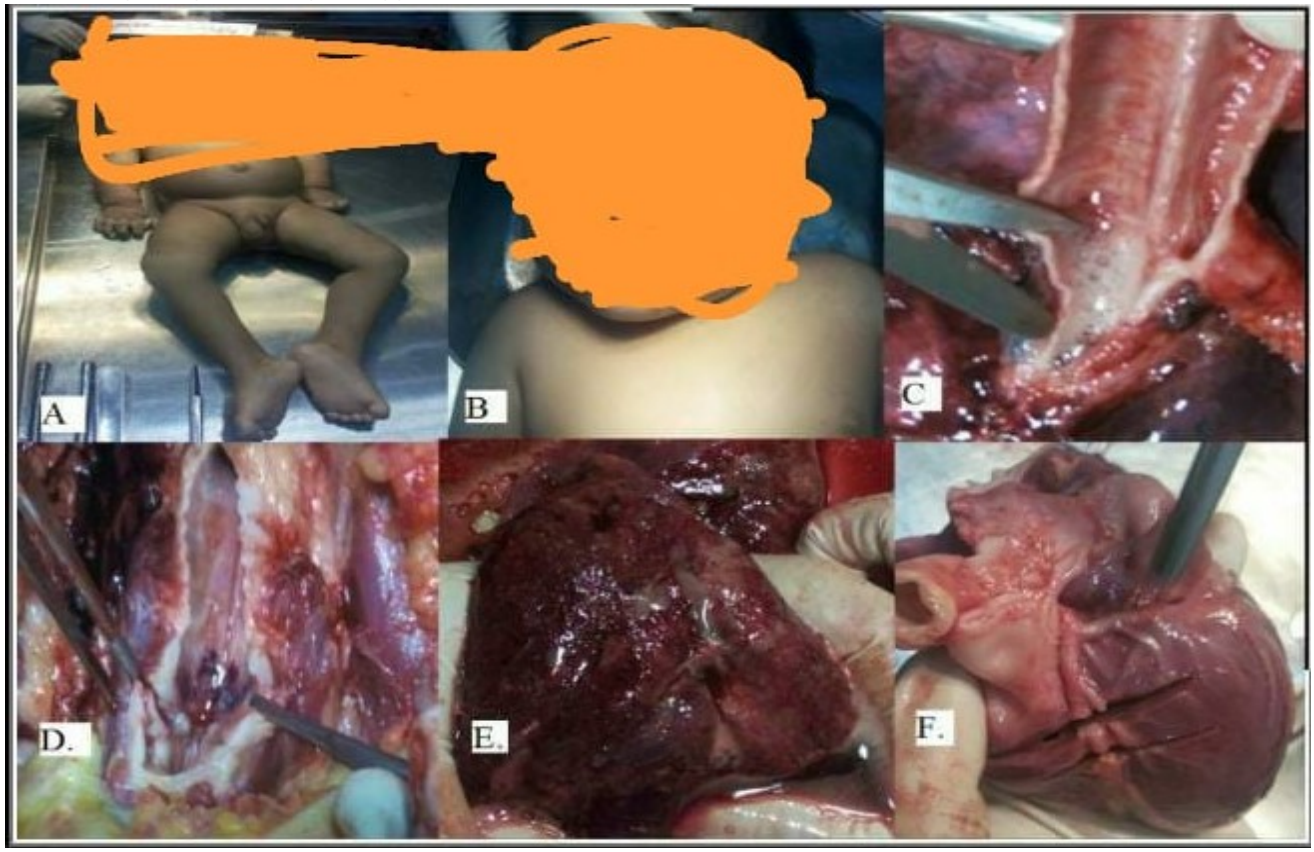
3. Case-series

The rationale of the study was the four cases that were observed by the authors in Western Maharashtra. **Case 1**: 03 months old girl, with an alleged history of being found unresponsive while sleeping. The deceased had taken feed four hours before being found unresponsive. On gross examination, the build was average with no congenital abnormalities. The stomach was filled with 300-400 ml of curdled milk. The same curdled milk was also seen in bronchioles on the cut section in both the lungs. The weight of the lungs was normal. No other systemic abnormalities were seen. **Case 2**: 20 months old male toddler with an alleged history of being found unresponsive while sleeping. Alleged history of upper respiratory tract infection for three days. The deceased had taken feed six-seven hours before being found unresponsive. The stomach was filled with 200 ml of curdled milk. The curdled milk was also seen in bronchioles on the cut section in both the lungs. The weight of the lungs was normal. No other systemic abnormalities were seen.

Case 3: A month-old baby with an alleged history of being found unresponsive while sleeping. The child was a known case of cleft palate and was under workup for fever of two days duration. The deceased had taken feed an hour before being found unresponsive. **Case 4**: 19 months Toddler male with an alleged history of being found unresponsive while sleeping (**Fig. 1**). The deceased had taken feed four hours before being found unresponsive. The study was undertaken to review the literature differentiating between the agonal aspiration of food and pulmonary aspiration leading to death.

Figure 1: Pictorial collage showing the Unresponsive child (A, B), Showing Milky contents in cut section of trachea (C, D) and Lungs congested on gross appearance (E).



4. Discussion

Gastric aspiration is defined as the inhalation of gastric contents into the airway or respiratory tract of an individual.[1] Difference between aspiration and regurgitation is that in the latter the gastric contents are found in the oropharynx or oesophagus.[2] Literature on this topic is limited and confusion between the terms gastric aspiration and pulmonary aspiration exists. We stick to gastric aspiration considering similar terms are used in ICD11 to certify a cause of death. The predisposing risk factors to aspiration are Altered levels of consciousness,

toddlers and elderly and nursing home residents, people with gastrointestinal (GI) and oesophageal abnormalities and patients with neurologic trauma and neuromuscular diseases are at increased risk.[5,6]

Additionally, abnormal anatomy, such as a cleft palate or delayed growth, from premature birth or a condition such as Down syndrome, brain damage or other problems, such as from cerebral palsy or infection, or Problems with the cranial nerves that control the muscles of swallowing and Neuromuscular diseases, such as spinal muscular atrophy with Medical procedures, such as a nasogastric tube or a tracheostomy and Gastroesophageal reflux disease (GERD) can also cause aspiration.[7]

Usually, in infants and toddlers, the larynx is one-third the size of an adult. The soft palate naturally obstructs the airway. The tongue is larger in the oropharynx than in the adult. Epiglottis is relatively long and narrow. Additionally, the large occiput of the infant against the neck makes it flex and increases the chances of airway obstruction.[8,9] Extra-thoracic airway calibre decreases during inhalation whereas intrathoracic airway diameter tends to increase. Airway resistance is determined by the diameter of the airway. it is a laminar flow. The airway is branched. During any infection of the upper respiratory tract increased chance of collapse of the upper airway occurs.[8,9] Aspiration syndromes are classified as aspiration pneumonitis, aspiration pneumonia, and airways obstruction. Aspiration pneumonia leads to chemical injury in the lungs, aspiration pneumonia leads to bacterial infection and airways obstruction causes mechanical obstruction which if not suctioned on time may lead to death. [10]

On aspiration of gastric contents, acid contents of the stomach cause damage to the airway epithelium. Large volume aspiration may cause airway obstruction. Small volume recurrent aspiration may induce chemical injury which will be seen as an inflammatory injury like the loss of alveolo-capillary permeability causing oedema (Figure 1). It may also lead to secondary bacterial infections causing pneumonia-like features in the lung.10 Unwitnessed gastric aspiration is one of the most difficult entities to diagnose. There are no gold standards for the diagnosis of aspiration-induced lung injury. Often it is a disease of exclusion, where other aetiologies of hypoxia such as pulmonary oedema, pulmonary embolism, or community or hospital-acquired bacterial pneumonia have been ruled out. Gastric aspiration seen in the upper airways is considered a post-mortem phenomenon or agonal. However, if the contents are seen in the terminal bronchioles, it may be antemortem. Facts like shifting the body or packing the body may cause displacement of food but not up to the terminal bronchioles.

Aspiration of gastric contents incites inflammation in the airways. The large volume can cause airway obstruction. It is mostly unwitnessed and induces acute respiratory distress leading to a fatal outcome. A small amount of regurgitant induces chemical injury in the airway causing features of dyspnoea, tachycardia, and hypoxia and causing aspiration pneumonitis. Superadded bacterial infection may be manifested by fever, cough, and radiological diagnosis of pneumonia. In long term, it may induce fibrosis in the lungs and lead to chronic airway disease. Mechanical obstruction can cause airway obstruction which depending upon the level of obstruction may have varied manifestations. if not, timely intervened it may lead to fatal outcomes that probably occurred in our cases. It may have acute dyspnoea, cyanosis and apnoea.[10] Aspirated fluids like saline, barium, ingested fluid (including water), and gastric contents with a pH exceeding 2.5 are non-toxic. Aspiration of large volumes of fluids produces abrupt suffocation by mechanical obstruction. The acidity of the contents makes it sterile and chances of infection immediately post aspiration are minimal.[11] Mendelson's syndrome is a chemical injury to the lungs in obstetric patients after spinal anaesthesia.[12] Aspiration syndrome includes aspiration pneumonitis, aspiration pneumonia, and mechanical obstruction. [10]

In recent advances on the topic, Pepsin, C-Reactive Protein, Serum procalcitonin, anti-human aloha lactalbumin have been found to be important in gastric aspiration. Bronchopulmonary dysplasia has been associated with detectable pepsin. The anti-human alpha-lactalbumin antibody is used to screen milk in aspirated material. Serial monitoring of serum procalcitonin levels is important in differentiating between bacterial pneumonia and aspiration pneumonia.[13,14,15] Unwitnessed death account for a maximum of these deaths thus posing a challenge for doctors and police to show the cause and manner of death. Due to its unexpected nature and it's being an unwitnessed event, it includes allegations on the

family or doctor. Cases of death in operation theatre due to mechanical obstruction of the airway by food or gastric aspiration are commonly seen. After a road traffic accident, aspiration of blood may cause death.[16]

5. Conclusion

Literature on the diagnosis of gastric aspiration as the cause of death is limited. It is considered as both a post-mortem phenomenon and a cause of death. It is an important causal factor in death in children and renewed focus should be given to research.

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