

Froth in Nose and Mouth as an Antemortem Sign in Hanging: An Observational Study

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Abstract

One of the most challenging tasks in autopsy of cases of death by hanging is to distinguish antemortem hanging from postmortem suspension. There is no specific gold standard test to distinguish between antemortem hanging and postmortem suspension, although a few signs are described in forensic literature. However, nowhere in published literature froth from nose and/or mouth is mentioned as one of the vital antemortem signs of hanging. After an incidental finding of typical fine whitish froth in an undisputed case of hanging in 2013, prospectively all the cases of hanging which had froth from nose or mouth were studied in detail. A total of five cases were noted over a period of five years (2013 -2017) with typical froth in undisputed cases of hanging. Possible mechanisms for froth formation in antemortem hanging and related literature are discussed in detail in this article along with the applied aspects.

Keywords: Antemortem hanging; postmortem suspension; partial hanging; froth

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Introduction:

Hanging is one of the 10 leading causes of death in the world accounting for more than a million deaths annually.¹ Hanging is the most common method of suicide in India, constituting 37% of cases of suicides in 2012.² Hanging is a form of asphyxia which is caused by the suspension of the body by a ligature, which encircles the neck, the constricting force being the partial or whole weight of the body.³ Hanging is almost invariably suicidal except in some masochistic accidental cases. Homicidal hanging is extremely rare.⁴

One of the most challenging tasks in an autopsy of hanging case is to distinguish antemortem hanging from postmortem

suspension of the body, as there is no specific gold standard test to distinguish between the two. Although a few signs are described in forensic literature, those are atypical and prevalence of such signs like Lefacie sympathetique is very rare as observed in several studies.⁵ Nowhere in published literature, froth from nose and/or mouth finds mention as one of the antemortem signs of hanging. Hence, the present study was aimed to observe and analyse froth through mouth and nose as an antemortem sign of fatal hanging.

Methodology

This was an observational and cross-sectional study conducted at Government Medical College, Aurangabad. All the cases of death by hanging where froth from nose or mouth was observed were studied in detail during the study period of January 2013 to December 2017. In all the cases viscera were analyzed for poison and histopathological examination of lungs was done. Hanging cases associated with froth wherein concomitant intoxication or comorbid

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Received on 22.11.2019

Accepted on 12.02.2020

condition was found were excluded from the study. A total of five cases of hanging (Fig1 & 2) were noted over a period of five years (2013-2017) with typical froth and are discussed in this article. Informants of the case were interviewed using predesigned and validated questionnaire. Details regarding type of hanging, position of knot, history of intoxication, approximate period after which body is brought down from suspended position, type of ligature material and concomitant history of disease morbidity were asked. Findings were interpreted and discussed considering the available literature and evidence.

Figure1: a- Case 1 showing whitish froth oozing through nose; b- Case 2 showing reddish froth in mouth; c and d- Case 3 and Case 4 showing whitish fine froth oozing through nostrils.



Observations and Discussion

Frothy secretions occurring after relief of obstruction and subsequent survival in attempted hanging cases is documented in the literature.⁶⁻⁹ However, the occurrence of frothy secretions in fatal hanging cases is unreported and the possible mechanism of such excess secretions remains obscure. Two pathophysiological mechanisms potentially explain the possible causation of froth in hanging. One possible cause could be post-obstructive pulmonary edema (POPE). Another cause could be increased secretions in laryngeal and/or tracheal lumen which may be of neurogenic origin, also called as Neurogenic Pulmonary Edema (NPE).¹⁰

Figure 2: Whitish frothy fluid in lumen of larynx & trachea of Case 5.



POPE is a potentially life-threatening complication in which pulmonary edema occurs shortly after relief of an upper airway obstruction.⁹ POPE is reported in hanging cases where the process of suspension is interrupted by rescue.¹¹ Similarly, POPE is documented in near hanging victims, who had survived for a varied period⁶, however, no literature is available mentioning the occurrence of POPE in fatal hanging cases. POPE may not be correct attribute to the pulmonary edema in attempted hanging cases, as video recordings of hanging episodes clearly shows continued unobstructed respiratory efforts.¹² It was suggested that the terminology posthanging pulmonary edema must be preferred to postobstructive pulmonary edema in such cases.¹³

NPE may be due to sympathetic stimulation (autonomic storm) or raised intracranial pressure, or myocardial stunning due to transient ischemia.¹⁰ Churning of such secretions due to involuntary respiratory efforts that occur during agonal stages of hanging may result in the frothy fluid. Such a phenomenon is facilitated when airway remains partially patent, and, there is prolonged agonal period during the process of hanging. These requisites are likely to occur in partial hanging where the process of death is not because of airway obstruction, but because of apoplexy leading to prolonged agonal period. Similarly, prolonged agonal period is also seen in situations where the airway obstruction is

asymmetrical and incomplete, as in atypical hanging, i.e. knot not being at occiput, as

the airways can withstand lateral compression but not antero-

Table 1: Details of cases in the study

Case	Age/sex	Material used	Type of hanging	Position of knot	Position of ligature mark	Nature of froth	Concomitant Intoxication	Histopathology of lungs
1	23/F	Nylon rope	Partial	Right mastoid	Above thyroid cartilage	Fine white froth from both nostrils	Nil	Pulmonary edema
2	38/M	Cotton saari	Partial	Occipital	On thyroid cartilage	Whitish blood tinged from the mouth	Nil	Pulmonary edema
3	30/M	Nylon rope	Partial	Right mastoid	Above thyroid cartilage	Fine white froth from nostrils	Nil	Pulmonary edema
4	18/M	Nylon rope	Atypical	Nape of neck towards the left side	On thyroid cartilage	Fine white froth from both nostrils	Nil	Pulmonary edema
5	25/M	Cotton cloth (chunni)	Partial	The left angle of mandible	On thyroid cartilage	Fine white froth from both nostrils	Ethyl alcohol (37 mg %)	Pulmonary edema

posterior.¹⁴ Among the cases discussed in this article four were due to partial hanging, and, one case was due to atypical hanging. The froth might have been produced due to the reasons mentioned above. While, the initiating event in POPE (Type I) is the generation of markedly negative transpulmonary pressure during a forceful inspiration against a closed upper airway, in contrast, neurogenic pulmonary edema (NPE) is caused by autonomic over-activity. The role of post-obstructive pulmonary edema or neurogenic pulmonary edema contributing to increased tracheal/laryngeal secretions is unknown. However, intuitively, only the latter mechanism i.e. due to NPE could be compatible with the occurrence of froth as a possible vital reaction of hanging. This sign can be added to the spectra of other signs of antemortem hanging. One should also remember that this sign may mislead autopsy surgeons (beginners) to think

drowning or poisoning as a possible cause of death instead of hanging. Nevertheless, froth formation is known to occur due to intoxication by some agents or edema due to pulmonary pathology; and both the said conditions may exist in conjugation with hanging. Hence, to rule out froth formation by an intoxicating agent or pre-existing pulmonary edema, and, to prove the vitality of froth formation in hanging, the following factors must be taken into account:

1. Negative toxicology screen,
2. Absence of pre-existing pulmonary edema,
3. Incomplete airway obstruction with prolonged agonal process e.g., in partial hanging or atypical hanging.

Searching for signs of vitality in the cases of suspected hanging is one of the major tasks to differentiate vital hanging from postmortem suspension of a body. Vital reactions produced in hanging can be by the

ongoing blood circulation system (e.g., congestive haemorrhage within the conjunctiva¹⁵, by attempted breathing (e.g., pneumomediastinum and cervical emphysema¹⁶, acute pulmonary emphysema¹⁷, agonal convulsions or mechanical stretching (e.g., Simon's bleeding)¹⁸, haemorrhages at the origin of the sternocleidomastoid muscles¹⁹, or by a reaction requiring an intact nervous system (e.g., salivary secretion). All these vital reactions are not compulsory in hanging, and, are non-specific and can be the sequel of a violent death. The secretion of saliva is a vital act due to stimulation of the salivary gland and is indicative of suspension during life because the secretion ceases after the cessation of circulation. Though evidence of dried salivary dribble marks from one of the angles of mouth is a sure sign of antemortem hanging, its absence alone will not suggest that the body was suspended after death.²⁰⁻²¹

Frothy secretions are probably not due to excess salivary secretions, instead are probably produced by a combination of autonomic over activity and attempted agonal breathing after the beginning of airway compression; therefore, as a sign of hanging, they seem to be more reliable. Increased amount of pulmonary surfactant may also play a vital role in froth formation as evidence from an immunohistochemical study of fatal asphyxia which showed a significantly increased intensity of pulmonary surfactant protein A (SP-A) staining in the intra-alveolar space accompanied by many massive aggregates in approximately 60% of cases, which were not found in the control group. Increased aggregates of pulmonary surfactant released from the alveolar wall were attributed to enhanced secretion caused by strong forced breathing or over-excitement of the autonomic nervous system by mechanical asphyxia.²²

Unfortunately, froth on the external surface might be intentionally or unintentionally removed during transportation of the body or prior to autopsy. It can also be underreported by

police at the scene of occurrence due to lack of awareness. Since there is no experimental or any other evidence for mechanism of production of froth in hanging deaths, further explanation would be highly speculative. It has to be considered that the froth in a hanging case is no obligate finding of hanging since there are variations in hanging situations. In forensic medicine subtle observation has often resulted in the detection of single finding which is of great significance regarding the mechanisms of its development or its vitality. The value and the significance of such empirically gained insight have to be proven either by retrospective or prospective analysis of important case series or by experiments. In conclusion, when intoxication or pre-existing pulmonary edema can be excluded, the findings of froth may serve as evidence of the vitality of a hanged person.

Conflict of interest: None

Source of funding: None

Ethical clearance: Obtained from Institutional Ethics committee

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