

CASE REPORT

Diagnostic Intricacies in Positional Asphyxia: Insights from a Case Study and Literature Overview

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ABSTRACT

Positional asphyxia may be defined as fatal ventilatory and circulatory failure caused by the fixation of the body in an abnormal position, which mechanically interferes with ventilation and venous return. This report describes a 30-year-old male who was found in a head-down position on a staircase. A thorough history and crime scene analysis unveiled that the deceased had fallen down the stairs and subsequently became unconscious. Autopsy revealed classical signs of asphyxia, and the injuries found were corroborated with crime scene evidence. The findings of the case were discussed by assessing Bell's criteria for positional asphyxia. Improvisations of Bell's criteria were suggested based on the case findings. Such cases present to forensic pathologists as sudden death, where crime scene examination, detailed history, and meticulous autopsy reveal evidence on the cause and manner of death.

KEYWORDS

• Positional asphyxia • Bell's criteria • Crime scene forensics

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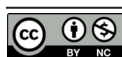
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INTRODUCTION

Positional asphyxia may be defined as fatal ventilatory and cardiocirculatory failure caused by fixation of the body in an abnormal position, which mechanically interferes with pulmonary ventilation by airway obstruction or interference with the inspiratory chest wall/diaphragm excursions and impairs venous reflow to the right ventricle.¹ It is a rare cause of death, accounting for only 1% of all asphyxial deaths in Lithuania, while only 30 cases have been reported over 9 years in Florida^{2,3} based mostly on the circumstances of the incident, along with particular external and internal findings, frequent in asphyxia (signs of sudden death. Although few cases have been reported in India, the complexity of diagnosing such cases remains challenging. The majority of these deaths are accidental.⁴⁻⁶ Most cases are accidental, but a handful of tortures and homicides by this method have also been reported.^{7,8} This article presents a case of positional asphyxia in a young male and explores into the diagnostic challenges surrounding the condition, while also suggesting potential refinements to the current diagnostic criteria.

Case report

A 30-year-old male was found lying in an unconscious state on the staircase at his apartment in the morning by his neighbors. He was taken to the Emergency Department of AIIMS, New Delhi, where he was declared as being brought dead. Since the cause and manner of death were not established, it was labeled a medicolegal case, and the body was sent for a medicolegal autopsy.

History and Crime Scene Analysis (Figure 1)

A detailed history revealed that the deceased went to the terrace of his building with alcohol bottles hidden in a bucket. He was not heard until the next morning, when he was found on the staircase of the apartment in a head-down position, with a bucket wedged between his body and the stairway wall. The crime scene photograph was submitted for analysis by the investigating authorities. Vomitus containing food particles was present at and below the level of the face (1st stair and below). One of his footwears was present near his head. The back of the white vest and the trousers worn by the deceased show pink paint particles from the stairway wall. Corresponding injuries are

present over the occipital region of the head, the back of the trunk and the front of the left leg. The stair immediately above the legs of the deceased has a relatively reduced space (5th stair from the bottom) due to the presence of another object (a white bucket) in its corner, which is in an upright position. These findings suggest that the deceased fell while crossing the 5th stair and ended up in the final position (head-down position) (Figure 1). Given the absence of any signs of foul play at the scene, and with no indication of struggle, it was hypothesized that the fall incapacitated him, leading to positional asphyxia.



Figure 1: Crime scene photograph showing the position of the victim when the body was discovered.

Pink-colored paint particles are present at the back of the vest and trouser (arrowheads), and brown-colored vomitus is present below the level of the face (arrow)

Autopsy findings

The autopsy was conducted 12 hours after the body was discovered. The deceased was moderately built and morbidly obese. Rigor

mortis is well established across all parts of the body. Purple-colored livores were present over the head and face, neck, upper part of the front and back of the chest, and lateral aspect of both thighs with contact pallor over the vertex and the anterior aspect of the thighs. No changes in decomposition were observed. Reddish abrasions were present over the occipital region, back of the trunk and anterior aspect of the left leg (Figure 2). Hyposphagma is present on both sides, with congested conjunctivae (Figure 3a & 3b). Multiple petechial hemorrhages are present over the face, and the scalp (subgaleal petechiae) is associated with a scalp contusion in the occipital region underlying the abrasion (Figure 3c). Contusions of the sternocleidomastoid muscle are present on both sides. The brain and lungs are congested

and edematous, weighing 1310g and 1230g, respectively. The pericardial sac is intact. The left anterior descending artery has a focal calcified eccentrically placed atherosclerotic plaque, resulting in approximately 60–70% lumen occlusion in its proximal one-third before the origin of the second diagonal artery (D2). Other coronary vessels are patent. The weight of the heart is 340g. The stomach contains approximately 450cc of brownish partially digested food particles, similar to the vomitus present at the crime scene. The remaining organs were congested and unremarkable. No other signs of external violence were observed. Examination of the blood by GC-HS with an FID (flame ionization detector) revealed ethyl alcohol levels of 173 mg/dl. The blood and viscera were negative for other common drugs and toxins.

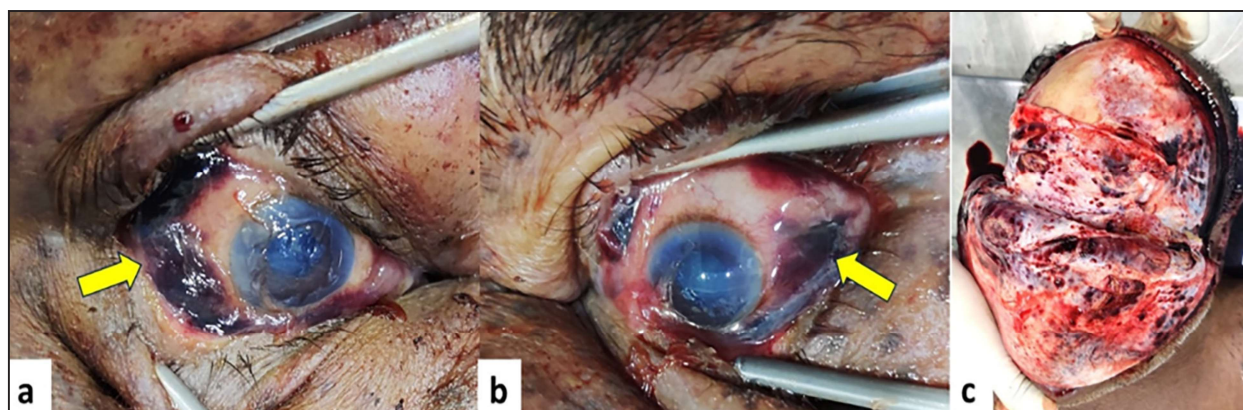


Figure 2: (a) External examination of the head showing two fresh abrasions (arrows) over the occipital region corresponding to the resting position of the head in the crime scene; (b) A fresh abrasion over the back of the trunk corresponding to the paint scratch marks; (c) Two fresh abrasions over the front of the left leg corresponding to the position of impaction with stairs

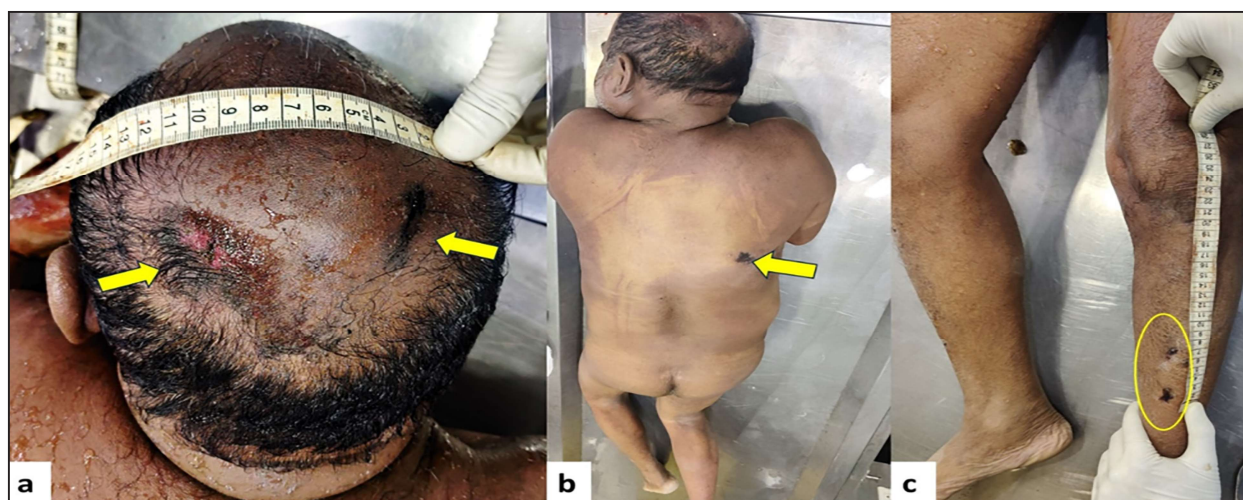


Figure 3: (a) External examination showing hyposphagma in the right eye; (b) Hyposphagma in the left eye; (c) Internal examination of the scalp showing extensive subgaleal petechiae

DISCUSSION

Positional asphyxia, in simple terms, denotes death due to abnormal positioning of the body, which compromises ventilation and, thereby, circulation. Interestingly, a strong male predominance was reported by Chmieliauskas *et al.*, which also applies to this case.² The most common positions associated with positional asphyxia include hyperflexion of the trunk, face-down positions with the mouth and nostrils occluded, sitting positions with hyperflexion of the neck and extended, and fixed shoulders, as in crucifixion.^{2,9-12} In these positions, respiratory dysfunction is the primary pathomechanism involved, in addition to circulatory collapse. In most cases, the chest is in a dependent position compared with the abdomen. This, in addition to increased intraabdominal pressure, prevents movement of the diaphragm during inspiration. Thus, the total and expiratory lung volumes become approximately equal. The vital capacity is further reduced by the inability of the ribs to expand against the resting body weight and the flexed abdomen. In some cases where the neck is hyperflexed/hyperextended, the trachea is also occluded, thus further compromising ventilation. Because of all these phenomena, inspiratory expansion of the lung is restricted. The negative intrathoracic pressure generated during inspiration acts as a major force driving venous return to the heart. In conditions where inspiratory movements are compromised, persistent high intrathoracic pressure reduces venous return, resulting in decreased cardiac output.¹³ Chmieliauskas *et al.* reported that inversion of the whole or upper body was one of the most common positions reported. In this case, the deceased was found in a prone position, with inversion of the upper body, a hyperflexed neck and vomiting around the mouth and nose. This position has been confirmed by crime scene analysis and the pattern of livores at autopsy. This has resulted in restricted inspiratory movements of the diaphragm, increased quantity of blood in the veins of the head and neck and decreased ventilatory capacity of the lungs resulting from neck hyperflexion and the presence of vomiting in and around the nose and mouth. In this case, the presence of asphyxial signs (bilateral hyposphagma with congested conjunctivae and petechial hemorrhages above the level of the neck) indicates high capillary hydrostatic pressure resulting from impaired

venous return due to the restriction of thoracic expansion, a hallmark of positional asphyxia.¹² These findings, along with the body's position, suggest that positional asphyxia was the cause of death.

Bell *et al.* outlined several criteria for diagnosing positional asphyxia³

1. Discovering a body in a position that compromises respiration.
2. History and scene of occurrence (SOC) evidence suggests that the deceased placed himself/herself in that position inadvertently, without the involvement of another person.
3. The deceased cannot relieve himself/herself from that position owing to incapacitation (either by drugs, disability, or disease).
4. There is no evidence of internal airway obstruction (i.e., choking, aspiration) or significant cardiac disease.
5. There is no evidence of suffocating gases/asphyxiant gases at the scene of occurrence.

These criteria are widely employed in diagnosing (in some cases, ruling out) a case of positional asphyxia. In the present case, the body was discovered in an abnormal position, the manner of which was thoroughly investigated and concluded to be accidental. Crime scene examination is an important part of death investigations. In India, where the inquest is conducted by police or magistrates, scenes of crime (SOCs) officers examine the crime scene, and forensic pathologists conduct an autopsy examination of the deceased. The knowledge of law enforcement agencies on conditions such as positional asphyxia is often scarce. Cases such as these highlight the importance of crime scene examination by experienced forensic pathologists. Although all other Bell's criteria are satisfied in our case, the one in conflict with our case and, in a general sense, is that no significant cardiac diseases should be present at the time of death. In our patient, the left anterior descending coronary artery had atherosclerotic narrowing of the lumen of approximately 60–70%. The criteria on which it is regarded as significant are left upon subjective conceptions. Although the literature has emphasized the necessity of at least 70% narrowing of the coronary artery to label it critical stenosis, the practicality of

these values in the context of forensic practice in developing countries such as India is debatable.^{12,14} Blaming the coronary arteries for every death is not a fair opinion. In this case, the atherosclerotic plaque was calcified and showed no acute changes, such as plaque rupture or infarction. Such cases cannot be labeled myocardial insufficiency, as they do not fulfill the above criteria. This criterion should be improved by supplementing it with 'acute cardiac pathologies.' Another essential point is to consider that although these criteria are designed specifically for deaths due to accidental positional asphyxia, the forensic literature, more often than not, mentions them as a checklist for diagnosing positional asphyxia. Positional asphyxia implies the cause of death, where the manner of death can be variable. The presence of homicidal intent does not rule out the possibility of positional asphyxia. Thus, the second criterion can also be improvised by removing 'without involvement of another person.' Chan *et al.* stated that although restrained body positions can increase stress levels, there is no evidence to infer that they alone cause positional asphyxia.¹⁵ Multiple elements prevent victims from freeing themselves when they end up in such lethal positions. Alcohol intoxication is a major contributing factor in cases of positional asphyxia.^{2,3,16} Bell *et al.* reported that alcoholism is a risk factor for positional asphyxia in 73.4% of their cases.³ In this case, the blood alcohol concentration was 173 mg/dl. Chmieliauskas *et al.* performed a literature review on cases of positional asphyxia and reported 37 cases meeting Bell's criteria.² They also reported that half of those 37 patients were intoxicated, with a mean blood alcohol concentration of 2.5 g/L (1.3–3.5 g/L). In accordance with Bell *et al.* and Chmieliauskas *et al.*, this patient also had a blood alcohol concentration of 173 mg/dl (1.73 g/L). Alcohol consumption is reported to cause reduced blood pressure, tachyarrhythmia and decreased myocardial contractility.^{17–19} No signs of self-liberation attempts were present, which indicates that the victim was incapacitated during/after the fall. In addition to alcohol intoxication, obesity also contributes to incapacitating victims.²⁰ Although weight was not recorded in this case, the deceased was morbidly obese, which also played a part in incapacitation. The presence of abrasions and contusions in the head also indicates the likelihood of concussion and its

contributory role in incapacitating the victim. Behera *et al.* reported a case in which a young girl slipped on a bathroom floor and died of positional asphyxia. In their case, concussion resulted in unconsciousness, whereas common contributing factors such as alcohol and obesity were absent.⁵ A major medicolegal concern to address in this case is whether the death of the individual would have occurred without alcohol intoxication. In this context, alcohol intoxication could have played two roles: 1) loss of coordinated movements causing slipping and falling from the staircase and 2) incivility of the victim. In this case, the blood alcohol concentration was 1.73 g/L, which can cause dizziness, disorientation, and muscular incoordination. However, slip and fall can be accidental and cannot be attributed solely to alcohol intoxication. At such minimum levels, the incapacitation of the victim cannot be explained only by alcohol intoxication.

Considering Schoenmackers' concept, in the present case, the primary stress level of the deceased was already raised to a higher secondary level by ethanol intoxication, obesity, and likely factors such as concussion and coronary artery disease. Asphyxia serves as a final blow, the critical stress level is reached, resulting in the death of the individual. In addition, almost 10% of the PA cases were found dead in stairways. Similar to the current case, most cases of positional asphyxia were discovered in confined places. Thus, positional asphyxia should be considered as a differential diagnosis during autopsy in cases where the body is found in confined places, which should be associated with thorough crime scene analysis.²¹

CONCLUSION

Positional asphyxia remains a challenging diagnosis for forensic experts, particularly in cases where multiple contributory factors such as alcohol intoxication, obesity, and cardiovascular disease are present. Thorough crime scene examination and a detailed autopsy are crucial in differentiating between accidental and intentional causes of death. Bell's criteria provide a useful framework for diagnosing positional asphyxia, but they should be refined to account for chronic cardiac conditions and the potential involvement of external factors, even in non-homicidal cases. Further research on the role of alcohol and comorbidities in

positional asphyxia is warranted.

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