



# Accidental death in a jack-knife position

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## ABSTRACT

Postural (or “positional”) asphyxia occurs due to a person being in a prolonged abnormal body position that prevents adequate breathing. Its diagnosis is based on several criteria, in particular the exclusion of involvement of other people and other causes of death. This case report is about a 73-year-old woman whose body was found in a jack-knifed position by her son. She was on the floor, wedged into the space between the legs and seat of a chair. The man attempted unsuccessfully to extricate her from that position and called for medical assistance. The rescuers took pictures of the scene before freeing the victim from the chair and providing unsuccessful resuscitation. External examination disclosed abrasions on the thighs and the back of the victim, which corresponded to parts of the chair, ecchymoses on the upper limbs (ascribed to the gripping attempts), conjunctival petechiae, facial congestion and swelling. Autopsy disclosed brain and lung congestion and edema and atherosclerotic coronary disease without acute cardiac lesions. All these considerations contributed to the cause of death being determined as being due to postural asphyxia.

## 1. Introduction

The term “positional” (or “postural”) asphyxia refers to a situation in which an enforced and abnormal adoption of the posture of the body for an extended time interferes mechanically with the pulmonary ventilation, causing a state of impaired oxygenation [1–6]. Fatalities from this type of asphyxia are rare, but a careful diagnostic approach to these cases is needed. Several postures are reported in the literature, such as hyperflexed head, head-down position [2,3,7,8], hogtie position due to restrain [4,9] jack-knife position [10] and reverse jack-knife position [11]. A case of postural asphyxiation due to jack-knife position is here presented.

## 2. Case report

A 73-year-old Caucasian female with no history of severe organic illness was found on the floor, wedged into the space between the legs and seat of a chair (Fig. 1A and B) by her son. The torso was hyperflexed in a jack-knife position. The man tried unsuccessfully to free his mother and then he alerted medical assistance. Rescuers took pictures of the scene (Fig. 1A and B) before breaking the chair to extricate the woman and providing unsuccessful resuscitation.

At postmortem examination, the face, the anterior aspect of the neck and of the upper thorax were bluish and swollen. Conjunctival petechiae were present. Fixed hypostasis involved the lower back and forearms. Several abrasions and ecchymoses were observed: a transverse linear abrasion on the

central middle back; a transverse bruise mark on the posterior surface of the upper right thigh; a transverse abrasion mark on the posterior surface of both thighs at the same level and distal to the previously described lesion (Fig. 2); various oval ecchymoses on both upper limbs (Fig. 3A, B and C).

Autopsy ruled out cardiovascular causes of death: a calcified coronary atherosclerosis was detected, without evidence of acute cardiac injuries. Brain edema and congestion, pleural, tracheal and pericardial petechiae and rib fractures were observed. The lungs were increased in weight (right = 930 g, left = 790 g; normal = 360–570 grams (right) and 325–480 (left) [12]), were congested and edematous and airways were free from obstructions.

The cause of death was determined as postural asphyxia due to enforced and prolonged jack-knife position.

## 3. Discussion

Reports in the literature indicate that most of the deaths due to positional asphyxia are accidental. Although in one case involving an elderly woman, the possibility of suicide could not be ruled out [1]. Reports often involve middle-aged victims in a drugged state, [2,10,13], or patients with neurological disease [1,14]. Cases involving elderly victims are also reported [1,7]. Diagnostic criteria for postural asphyxia were developed by Bell and Padosch [2,13], affirming that:

- 1) the person must be discovered in a position that does not allow adequate breathing;

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Fig. 1. A and B. The scene before the rescuers removed the victim: the body of the woman is on the floor, wedged into the space between the legs and seat of a chair.



Fig. 2. Lesions due to the contact with the parts of the chair; details of the transverse abrasion on the back and of the linear transverse bruises on the posterior aspects of the thighs.

- 2) scene and historical evidence must show that the decedent placed him/herself in that position without the action of other people;
- 3) the victim could not escape that position;
- 4) there is no evidence of internal airway obstruction;
- 5) gas intoxication has to be ruled out;
- 6) there must be no evidence of significant cardiac disease.

Point 6) was modified by Byard, stating that “*in certain cases an underlying organic illness (cardiac or respiratory) may be either unrelated to the terminal episode or may predispose to postural asphyxia*” [1].

In this case the victim was found on the floor, wedged into the space between the legs and seat of the chair. Bruises on the upper limbs were compatible with gripping lesions, confirming the hypothesis that her son attempted to extricate the woman from that abnormal position. The morphologies of the linear bruises were compatible with the body being in contact with the rungs (posterior aspect of the thighs) and the flat surfaces (back) of the chair. It was very difficult to extricate the victim from that position, since rescuers had to break the seat of the chair to liberate her. The hyperflexed position of the trunk and the neck was able to prevent adequate chest wall and abdomen movements. Autopsy highlighted that airways were free, no other acute causes of death were discovered, and no evidence of gas intoxication was found. The combination of circumstantial evidence, morphological findings, and lack of evidence of involvement of another person suggested that an accidental series of

events led to the woman being found in this position. Because of the coronary atherosclerosis lesions found at autopsy, it is possible that an underlying history of coronary disease was the risk factor that predisposed this patient to an unexpected cardiac event at this time. A sudden cardiac death event could have led to a fall from the chair onto the floor. If the woman somehow became entrapped under the chair in the sitting position while unconscious, this jack-knife position would have prevented breathing movements.

Death by positional asphyxia is related to different mechanisms. Jack-knife position prevents adequate breathing, impeding chest wall, abdominal and diaphragm movements [5] and causing a partial or complete airway obstruction [10]. Furthermore, positional asphyxia is also characterized by an obstructed venous return to the right heart, which can cause an increased hydrostatic pressure in the upper parts of the body and an increased transmural venous pressure in the brain [7,13]; an increased static pressure in the carotid sinus may also occur, resulting in a decreased arterial pressure [3,10,15]. In cases of a conscious victim, a catecholamine hyperstimulation may be present, leading to increased metabolic rate oxygen demand, tachycardia, and potential arrhythmias, and promoting brain hypoxia.

External and internal signs depend on the pathophysiology of postural asphyxia, but in several cases no specific findings may be highlighted by body examination [1]. Petechiae may be present on conjunctivae and on the serous membranes [1,4]; their formation is directly proportional to the degree of vein occlusion and is in inverse relation to arterial compression above the heart [16]. However only punctiform hemorrhages not located on lividity areas may be classified as vital petechiae [4]. Conjunctival petechiae and remarkable facial congestion and swelling may be present in cases where the head has been dependent, but they still turn out to be unspecific and difficult to interpret [1,3,10].

Postural asphyxia may lead to brain edema and leptomeninges congestion [3]. Similarly to another case-study concerning a fatality due to jack-knife position, we reported increased lung weight, lung congestion and edema [10].

Diagnosis of postural asphyxia must be based on a solid foundation. It is essential to have a proper scene investigation to demonstrate that the victim was found in an abnormal position preventing adequate respiration and that it was not possible to change that posture. Other causes of death, both natural or violent must be excluded.

In this case the role of the rescuers was fundamental, since they took pictures as they entered the scene, witnessing the abnormal posture of the victim. The only findings compatible with an aggression were some ecchymoses on the forearms, but they corresponded to the attempts to extricate the woman from the chair by her son. Autopsy excluded other



Fig. 3. A, B and C. Ecchymoses on the upper limbs.

organic causes of death. It was thus assumed that the women attempted to sit on the chair, but she slipped, and her body was dragged down into a jack-knife position wedged into the space between the legs and the seat of a chair.

Although some people may disagree with the final police conclusion in this instance, this report aims to document the findings from this particular case, add to the growing literature in this area, and stimulate constructive forensic conclusions.

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### Declaration of Competing Interest

The authors declare no conflict of interest.

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