REVIEW ARTICLE

Hanging: A Review on Management

Ashray Vasanthapuram[1], Kushal Pandya[2], Sithi Sabeera M[3], Deepthi K Narasimha[4]

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Abstract

Hanging is a common means of suicide worldwide. As per the Crime Records Bureau of India, hanging accounted for almost 53.6–57.8% of all suicidal deaths in 2019 and 2020, respectively. The incidence of hanging across emergency departments in India, as reported in previous studies, has varied from 5.3% and rising to 8.6% in recent times. The article aims to contribute to the understanding of the most optimal management of hanging patients in the emergency department. Hanging is defined as a form of asphyxia occurring due to the weight of the body being suspended by a ligature material around the neck. The common physical features of hanging noted in literature are facial congestion, petechiae, and cyanosis. These are considered classical signs of asphyxia. Patel et al. and Simonsen reported facial congestion in 77.5 and 52.5%, respectively. Clément et al. noted petechial hemorrhage in 46% of cases. The initial assessment of near-hanging patients begins with the advanced trauma life support (ATLS) primary survey. Airway, breathing, circulation, disability, and exposure are noted accordingly and intervened. Patients with Glasgow Coma Scale (GCS) <9 and signs of airway compromise (laryngeal fracture or tracheal trauma) require early intubation. It is worth noting that computed tomography (CT) of the neck and brain plays a crucial role in ruling out a majority of injuries associated with hanging, and it also assists in devising an effective management plan for these injuries. Over the years, the treatment and management of near-hanging have largely remained the same; however, the evaluation has changed with the advancement and easy availability of CT imaging at most centers. While the literature on the outcomes and management of hanging cases may be limited, prompt and appropriate treatment has shown to improve the chances of survival for most individuals.

Keywords: Critical care, Emergency care, Hanging.

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Introduction

Hanging is a common means of suicide worldwide. As per the Crime Records Bureau of India, hanging accounted for almost 53.6–57.8% of all suicidal deaths in 2019 and 2020, respectively.[1] The incidence of hanging across emergency departments in India, as reported in previous studies, has varied between 5.3% and rising to 8.6% in recent times.[2] This necessitates a systematic approach by the emergency physician in the management of hanging cases. The article aims to contribute to the understanding of the most optimal management of hanging patients in the emergency department.

Pathophysiology of Hanging

Hanging is defined as a form of asphyxia occurring due to the weight of the body being suspended by a ligature material around the neck. Hanging has been a subject of research since the 18th century, and numerous hypotheses based on animal and human autopsy studies have been published. Over the course of time, three primary mechanisms of death in hanging have been extensively debated and revisited, even in the 21st century. The first school of thought originated in the 18th century, in which researchers proposed that hanging resulted in tracheal occlusion and subsequent asphyxia. This occlusion led to inadequate ventilation and gas exchange, ultimately contributing to death.[3] As researchers delved deeper into the study of hanging, they gradually realized that significant compression was necessary to obstruct the cartilages of the larynx and trachea. However, in cases where such compression did occur, it was primarily due to the positioning of the noose above the larynx, which also resulted in the compression of the trachea. This understanding gave rise to an alternative perspective, focusing on the compression of structures other than the cartilage, particularly blood vessels.[4] A significant observation by Hoffman was the difficulty in infusing fluids into the blood vessels of the neck in a hanging patient. According to this, the pressure from the ligature around the neck leads to compression of neck vessels, resulting in reduced oxygen supply to the brain. This observation formed the basis of the second school of thought. Brouardel, in the late 19th century, further supported this theory by noting a correlation between the degree of retinal anemia and cerebral ischemia in hanged animals.[5]

The suspended weight of the body also results in loss of muscle tone, leading to arterial compression and thus worsening hypoxic brain injury.[6,7] Authors across various publications have consistently reported occurrences of loss of consciousness, convulsions, and death. The rapid onset of unconsciousness has given rise to a third perspective, known as vagal stimulation.[4] The underlying cause of sudden death in hanging can be attributed to the compression of baroreceptors present in the carotid sinus, carotid sheath, and carotid body. This phenomenon is commonly referred to as

[1,3,4]Department of Emergency Medicine, Aster Whitefield Hospital, Bengaluru, Karnataka, India

[2]Department of Emergency, Aster Whitefield Hospital, Bengaluru, Karnataka, India

Corresponding Author: Kushal Pandya, Department of Emergency, Aster Whitefield Hospital, Bengaluru, Karnataka, India, Phone: +91 9035841805, e-mail: doc.kush87@gmail.com

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"vasovagal shock" or "reflex cardiac arrest."[8] Nevertheless, the precise mechanism of death in hanging continues to be a subject of debate and ongoing investigation. Several theories have been proposed, but the fundamental concept remains unchanged.

Physical Findings

The common physical features of hanging noted in literature are facial congestion, petechiae, and cyanosis. These are considered classical signs of asphyxia. Patel et al.[9] and Simonsen[10] reported facial congestion in 77.5 and 52.5%, respectively. Clément et al.[11] noted petechial hemorrhage in 46% of cases. One of the most significant antemortem signs is the presence of dribbling of saliva from the corners of the mouth.[12–14] However, when a patient is presented to the emergency room, such signs may not be present, as relatives may have wiped away the saliva or attempted to offer water. Another common finding, particularly in complete hanging, is the observation of a whitish glistening subcutaneous tissue beneath the ligature mark. This appearance is caused by the condensation of subcutaneous fat under the furrow, known as an argent line, and has only been occasionally reported in the literature.[15,16] Suárez-Peñaranda et al.[17] found the presence of this "argent" line in 76.6% of hanging deaths, although no association was noted with the mode of suspension.

Hemorrhage in at least one of the neck muscles is usually present, more frequently in complete hanging compared to near hanging. Saisudheer and Nagaraja,[18] Dixit et al.,[19] and Luke et al.[20] reported neck muscle hemorrhage in 28, 26, and 24.5% of hanging deaths, respectively. Fractures of the hyoid bone occurred less commonly, with a frequency of 10.2%, and thyroid cartilage fractures were observed in 3.1% of hanging deaths, predominantly among males. Fractures of the neck structures were more commonly associated with the use of a hard-fixed noose[17] and occurred more frequently in complete hanging.[19] Suárez-Peñaranda et al.[17] noted that the incidence of these fractures was independent of the mode of suspension. Unlike fractures of the hyoid bone and thyroid cartilage, it is uncommon for the cervical spine to be fractured in cases of suicidal hanging unless there is a long drop, which typically occurs when the victim selects a high tree branch as the point of suspension for hanging.[20] However, cervical spine fractures are commonly observed in judicial hanging cases.[21] Other significant findings in hanging deaths include congestion of organs, subpleural petechial hemorrhage, and brain edema.[13,14]

A drop in height equal to or greater than the height of the individual also contributed to poor outcomes in previous studies.[22]

Initial Assessment and Management

The initial assessment of near-hanging patients begins with the advanced trauma life support (ATLS) primary survey. Airway (A), breathing (B), circulation (C), disability (D), and exposure (E) are noted accordingly and intervened.

Patients with a Glasgow Coma Scale (GCS) of <9 and signs of airway compromise (laryngeal fracture or tracheal trauma) require early intubation.

Airway Injuries

The red flag signs of airway compromise are high-pitched voice, hoarse voice, excessive secretions, and subcutaneous emphysema. The occurrence of these signs may be uncommon and is usually seen in <5% of hanging patients who sustained laryngeal injury.[23]

Endotracheal intubation in hanging patients should be performed by rapid sequence intubation with manual in-line cervical spine stabilization. A difficult airway cart should be kept ready for use if required. Following intubation, the application of a hard cervical collar is recommended till appropriate cervical spine imaging is obtained. Adjunctive testing with chest wall ultrasound and chest radiograph can be used to determine the presence of a pneumothorax. Laryngeal injuries are relatively uncommon, resulting in limited available literature on the topic. The reported incidence of laryngeal fractures in near-hanging patients varies widely, ranging from 5 to 40%, with the majority of studies reporting an incidence of <6%. The superior horn of the thyroid cartilage is the most frequently affected site of injury.[23] Conservative management is recommended for most patients with laryngeal injuries. This may involve dietary restrictions (soft and liquid diet), the placement of a feeding tube for nutrition, and pain control. In cases where operative intervention is necessary, strategies such as reduction, fixation, or removal of a portion of the hyoid bone may be employed. A tracheostomy may be performed if respiratory distress occurs.[23] A computed tomography (CT) angiogram of the neck would identify the following injuries in addition to vascular injuries of the neck.

The various injuries related to near-hanging have been described in Table 1.

Cervical Spine Injuries

Cervical spine injuries in hanging are uncommon but should not be neglected.

In a single-center study spanning 10 years, it was found that 5% of near-hanging patients sustained a cervical spine fracture, although the type of fracture was not specified.[23]

Another retrospective multicenter trial reported an incidence of 2.9% cervical spine injuries among 692 patients but did not provide details about the specific fracture patterns.[24] The placement of a hard cervical collar till the imaging workup is completed, restricts any undue mobility to the cervical spine.[26] The plain radiograph may be insufficient in identifying fractures of the cervical spine as its sensitivity has been reported to be 50%.[27] This reiterates the need for CT angiography imaging of the cervical spine, which would confirm or rule out cervical spine fractures and neck vessel injuries. The classic cervical spine fracture seen is the hangman's fracture. The hangman's fracture pattern involves bilateral C2 pars interarticularis fractures, a pattern that accounts for up to 20% of all cervical spine fractures and occurs more frequently in hanging than other mechanisms, such as motor vehicle crashes.[28] Spine fractures above T6 levels can cause neurogenic shock due to spinal cord compression. This is characterized by loss of sympathetic innervation, resulting in hypotension with inappropriate bradycardia. Treatment includes the requirement of intravenous fluids and inotropes. For patients presenting with spinal shock

Table 1: Injuries and rates of occurrence from hanging[23–26]

Injury	*Rate of occurrence*
Anoxic brain injury	8–35.7%
Cervical spine fracture	2.9–5%
Laryngeal fracture	1.4–5.3%
Tracheal injury	1.6%
Pharyngeal laceration	Up to 1.6%
BCVI	1.6–6.1%

after spinal fractures, an urgent spine surgeon's opinion would be required.

Brain Injuries

Blunt cerebrovascular injury (BCVI) is a common type of injury observed in cases of hanging. BCVI refers to damage to the carotid or vertebral arteries, typically caused by the shear forces involved in hanging. One of the potential complications of BCVI is stroke, which can lead to significant disability or even death within 24 hours.[7] CT angiography is widely accepted as the gold standard for diagnosing BCVI. It allows for the visualization and assessment of vascular injuries. It provides valuable information for determining the extent and severity of the injury, guiding further management decisions. Most vascular injuries resulting from BCVI are classified as low-grade. Studies comparing the use of antiplatelet and anticoagulant medications for managing BCVI have not shown significant differences in outcomes. As a result, aspirin is commonly used as the treatment of choice for low-grade injuries. However, high-grade injuries may require interventional angiographic procedures to address the severity of the vascular damage and prevent complications.[7]

The ct Puzzle

The lack of clear guidelines regarding the use of CT angiography in hanging patients can present a dilemma. In their retrospective analysis of 128 hanging incidents, Heimer et al.[29] aimed to investigate diagnostic bias between clinical and forensic radiology. They specifically focused on identifying underreported image findings, noting that disagreement occurred in 36 (29.3%) cases, primarily related to nonfatal injuries. These 36 cases represented a significant portion, accounting for 52 (69.2%) of all cases with a radiological finding. A synchrony between the treating physician and the reporting radiologist highlighting the mechanism of injury and physical examination findings may enhance the accuracy of reporting of minor injuries on CT scanning among patients of hanging. Studies, such as the one conducted by Leichtle et al., have shown that a significant percentage (23%) of patients with BCVI would not have been detected using clinical criteria alone. Therefore, until a robust screening criterion is established, it is recommended to consider performing CT angiography in hanging patients to ensure proper evaluation.[30] The correlation between low GCS scores and the severity of brain injuries may not always be straightforward. A CT scan may be necessary to rule out potentially significant intracranial pathologies that may not be apparent based on clinical assessment alone.[23] In the case of cervical spine injuries, clinical clearance is typically the standard approach for awake and alert patients. However, controversy surrounds the issue of C-spine clearance in obtunded patients without obvious neurological deficits.[31]

When dealing with hanging patients, it is crucial to closely examine the neck for injuries. CT imaging studies have revealed a high incidence (40%) of laryngohyoid fractures in individuals who have been hanged. The superior horn of the thyroid cartilage is the most affected site. This aspect should be considered, especially in older individuals.[31]

Pulmonary Sequelae

Pulmonary sequelae like aspiration pneumonitis, postobstructive pulmonary edema (POPE), and adult respiratory distress syndrome (ARDS) are commonly seen in near-hanging survivors.[24]

Of particular interest is POPE in hanging victims. POPE results from a negative intrathoracic pressure that develops when the patient breathes against an airway occlusion caused by the noose over the neck. The resulting negative pressure may range from −4 cm to as high as −140 cm of water,[7] resulting in pulmonary edema. The diagnosis of POPE can be confirmed by a chest X-ray and bedside lung ultrasonography (evidence of B lines). Positive pressure ventilation (up to 48–72 hours) and diuresis with maintenance of a negative fluid balance have proven to be beneficial in the management of POPE.

Conclusion

Hanging is a common presentation to the emergency department and requires a detailed clinical evaluation. Over the years, the treatment and management of near-hanging have largely remained the same; however, the evaluation has changed with the advancement and easy availability of CT imaging at most centers. While the literature on the outcomes and management of hanging cases may be limited, prompt and appropriate treatment has been shown to improve the chances of survival for most individuals. Many patients who receive timely intervention can be safely discharged home. Institutions should consider developing their guidelines for the identification and management of injuries in hanging cases, considering the available resources and expertise. These guidelines can help standardize the evaluation and treatment process, ensuring that all necessary assessments are conducted and appropriate interventions are provided. Collaborative efforts between different specialties, such as emergency medicine, critical care, surgery, and neurology, can contribute to a more comprehensive approach to the management of hanging cases.

Orcid

Ashray Vasanthapuram https://orcid.org/0009-0007-5907-8979
Kushal Pandya https://orcid.org/0000-0002-4439-2400
Sithi S Mohamed Najeeb https://orcid.org/0000-0003-4831-4597
Deepthi K Narasimha https://orcid.org/0009-0001-5824-4433

References

1. Nagar N, Bastia BK. The demographic profile of suicidal hanging deaths in North India. Cureus 2022;14(10):e30409. DOI: 10.7759/cureus.30409
2. Ranjan M, Kale Y, Selvan J, et al. Near hanging: profile, emergency management, and outcome. Med J DY Patil Vidyapeeth 2022;15(5): 728–732. DOI: 10.4103/mjdrdypu.mjdrdypu_788_21
3. Tardieu A. Étude Médico-Légale Sur La Pendaison, La Strangulation Et La Suffocation. Ann Hyg Pub Med Leg 1870;33:78–128.
4. Hofmann E. Nouveaux éléments en médecine légale. Paris: JB Baillière, 1881.
5. Brouardel P. La pendaison, la Strangulation, la Suffocation, la submersion. Paris: J.B Bailliere et fils; 1897.
6. Ramakrishnan TV. Near Hanging. Clinical Pathways in Emergency Medicine. 2016. pp. 497–502.
7. Udeshi A, Cantie SM, Pierre E. Postobstructive pulmonary edema. J Crit Care 2010;25(3):508.e1–508.e5. DOI: 10.1016/j.jcrc.2009.12.014
8. Knight B, Saukko P. Knight's Forensic Pathology. London: E Arnold; 2004:368–389.
9. Patel AP, Bansal A, Sheikh IV, et al. Study of hanging cases in Ahmedabad region. J Indian Forensic Sci 2012;34(4):342–335. https://www.researchgate.net/publication/279568225_Study_of_hanging_cases_in_Ahmedabad_region
10. Simonsen J. Patho-anatomic findings in neck structures in asphyxiation due to hanging: a survey of 80 cases. Forensic Sci Int 1988;38(1-2):83–91. DOI: 10.1016/0379-0738(88)90012-6

11. Clément R, Guay JP, Redpath M, et al. Petechiae in hanging: a retrospective study of contributing variables. Am J Forensic Med Pathol 2011;32(4):378–382. DOI: 10.1097/PAF.0b013e3181db7ecf
12. Sauko P, Knight B. Fatal pressure of the neck. In: Sauko P, Knight B, (Eds). Knight's Forensic Pathology, 3rd edition. London, UK: Edward Arnold; 2004. pp. 368–393.
13. Reddy KSN. The Essentials of Forensic Medicine and Toxicology. 29th edition. Hyderabad, India: Om Sai Graphics; 2010. pp. 302–309.
14. Nandy A. Principles of Forensic Medicine, 3rd edition. Reprinted, Calcutta: New Central Book Agency (P) Ltd; 2010. pp. 517–529.
15. Concheiro L, Suarez-PeC_aranda JM. Asfixias mecanicas. In: Villanueva C, (Ed). Medicina legal y Toxicologia, 6th edition. Barcelona, Spain: Masson; 2004. pp. 460–478.
16. Thoinot L. Tratado de Medicina Legal, Vol. 1. 2nd edition. Barcelona, Spain: Salvat Editores; 1923. p. 603.
17. Suárez-Peñaranda JM, Alvarez T, Miguéns X, et al. Characterization of lesions in hanging deaths. J Forensic Sci 2008;53(3):720–723. DOI: 10.1111/j.1556-4029.2008.00700.x
18. Saisudheer T, Nagaraja TV. A study of ligature mark in cases of hanging deaths. Int J Pharm Biomed Sci 2012;3(3):80–84. https://www.scribd.com/document/151268434/A-Study-of-Ligature-Mark-in-Case-of-Hanging-Deaths
19. Dixit PG, Mohite PM, Ambade VN. Study of histopathological changes in thyroid, salivary gland and lymph nodes in hanging. J Forensic Med Toxicol 2001;18(2):1–4. https://www.researchgate.net/publication/282736822_Study_of_histopathological_changes_in_thyroid_salivary_gland_and_lymph_nodes_in_hanging.
20. Luke JL, Reay DT, Eisele JW, et al. Correlation of circumstances with pathological findings in asphyxial deaths by hanging: a prospective study of 61 cases from Seattle, WA. J Forensic Sci 1985;4:1140e7. DOI: 10.1016/j.jflm.2014.11.003
21. Shepherd R. Simpson Forensic Medicine, 12th edition. London, UK: Arnold; 2003. pp. 98–101.
22. Gandhi R, Taneja N, Mazumder P. Near hanging: early intervention can save lives. Indian J Anaesth 2011;55(4):388–391. DOI: 10.4103/0019-5049.84863
23. Salim A, Martin M, Sangthong B, et al. Near-hanging injuries: a 10-year experience. Injury 2006;37(5):435–439. DOI: 10.1016/j.injury.2005.12.013
24. Hsu CH, Haac BE, Drake M, et al. EAST Multicenter Trial on targeted temperature management for hanging-induced cardiac arrest. J Trauma Acute Care Surg 2018;85(1):37–47. DOI: 10.1097/TA.0000000000001945
25. Berke DM, Helmer SD, Reyes J, et al. Injury patterns in near-hanging patients: how much workup is really needed? Am Surg 2019;85(5):549–555. DoI: 10.1177/000313481908500534
26. Schellenberg M, Inaba K, Warriner Z, et al. Near hangings: epidemiology, injuries, and investigations. J Trauma Acute Care Surg 2019;86(3):454–457. DOI: 10.1097/TA.0000000000002134
27. Como JJ, Diaz JJ, Dunham CM, et al. Practice management guidelines for identification of cervical spine injuries following trauma: update from the Eastern Association for the Surgery of Trauma Practice. J Trauma 2009;67(3):651–659. DOI: 10.1097/TA.0b013e3181ae583b
28. Stiell IG, Wells GA, Vandemheen KL, et al. The Canadian C-spine rule for radiography in alert and stable trauma patients. JAMA 2001;286(15):1841–1848. DOI: 10.1001/jama.286.15.1841
29. Heimer J, Arneberg L, Blunier S, et al. Under-reporting of forensic findings: craniocervical emergency imaging in cases of survived hanging. Forensic Sci Med Pathol 2023. DOI: 10.1007/s12024-023-00665-8
30. Leichtle SW, Banerjee D, Schrader R, et al. Blunt cerebrovascular injury: the case for universal screening. J Trauma Acute Care Surg 2020;89(5):880–886. DOI: 10.1097/TA.0000000000002824
31. Fukumoto W, Mitani H, Kuno Y, et al. Incidence and factor analysis of laryngohyoid fractures in hanging individuals-computed tomography study. Eur Radiol 2021;31(10):7827–7833. DOI: 10.1007/s00330-021-07932-8