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Instantaneous rigor - the challenge of securing an airway in cardiac arrest: a case report

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Abstract
Cadaveric spasm, also known as instantaneous rigor, is a rare and poorly understood phenomenon characterized by immediate muscle rigidity at the moment of death or cardiac arrest. This can result in severe trismus, making conventional airway management impossible. We present a case of a morbidly obese patient who suffered a sudden cardiac arrest with instantaneous rigor, necessitating an urgent surgical cricothyrotomy. This report underscores the need for early recognition of this condition, rapid decision-making regarding airway management, and the importance of specialized training for emergency physicians, particularly in anatomically challenging scenarios.

Keywords Instantaneous rigor, Difficult airway, Surgical cricothyrotomy, Emergency airway management, Cardiac arrest

Introduction

Airway management is one of the most critical skills in emergency medicine, particularly during cardiac arrest [1]. Endotracheal intubation remains the gold standard for airway control, but certain conditions may render this approach impossible [2]. Instantaneous rigor, also known as cadaveric spasm, is a rare phenomenon characterized by sudden and extreme muscular rigidity at the moment of death or severe hypoxia-induced cardiac arrest [3]. Unlike rigor mortis, which develops progressively over several hours, instantaneous rigor occurs immediately and can severely impact airway interventions [4].

This rare occurrence can lead to trismus, preventing traditional orotracheal intubation and necessitating alternative airway techniques [5]. Emergency providers must be prepared to rapidly recognize this condition, differentiate it from rigor mortis, and implement an appropriate airway management strategy without delay [6].

Case report

A 35-year-old woman with a history of hypertension and type 2 diabetes was found unconscious and not breathing by her daughter, who immediately called emergency services. Bystander cardiopulmonary resuscitation (CPR) was initiated under telephonic guidance while first responders were dispatched.

Upon arrival, police officers maintained chest compressions until the emergency medical services (EMS) team assumed resuscitative efforts. The initial assessment revealed asystole on rhythm analysis. The EMS team continued high-quality cardiopulmonary resuscitation (CPR), established ventilation using a nasopharyngeal

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airway device in conjunction with a bag-valve mask, and prepared for orotracheal intubation. However, upon attempting laryngoscopy, the patient was found to have severe trismus affecting the temporomandibular joint, preventing mouth opening and direct laryngoscopy. This unexpected presentation raised concerns regarding the occurrence of instantaneous rigor.

Orotracheal intubation was not feasible, necessitating an emergency surgical cricothyrotomy using the bougie-assisted cricothyrotomy technique (BACT). Despite the technical challenges posed by the patient's extreme obesity (BMI 55), a size 6 endotracheal tube was successfully inserted approximately 12 min after the initiation of CPR. Unfortunately, despite 30 min of resuscitative efforts, return of spontaneous circulation (ROSC) was not achieved, and the patient was pronounced deceased.

Postmortem examination revealed hypertrophic cardiomyopathy, pulmonary edema, and early signs of respiratory infection. Toxicological analysis found no evidence of intoxication. The suspected cause of cardiac arrest was hypoxia-induced circulatory failure.

Discussion

Pathophysiology of instantaneous rigor

Instantaneous rigor, also known as cadaveric spasm, instantaneous rigidity, or cataleptic rigidity, is a rare and poorly understood phenomenon in which muscle stiffening occurs immediately at the moment of death or cardiac arrest. This condition differs fundamentally from rigor mortis, which typically develops progressively within 2 to 6 h after death and follows a predictable sequence of onset, peak, and resolution [1]. Adenosine triphosphate (ATP) depletion is a key factor, as ATP is required for muscle relaxation. When ATP is abruptly exhausted, actin-myosin cross-bridges remain locked, causing immediate rigidity [2, 3]. This process mirrors rigor mortis but occurs instantaneously.

Extreme stress or trauma, such as drowning, electrocution, or severe physical exertion, may trigger a surge of catecholamines, leading to a hyper-contracted muscular state [1, 2]. Neuromuscular factors, including excessive neuronal stimulation in electrocution, opioid intoxication, or seizures, can further contribute to sustained contraction [3–5]. Metabolic disturbances such as metabolic acidosis and hyperkalemia also play a role. A documented case of a young athlete who experienced cardiac arrest during a marathon demonstrated instantaneous rigidity linked to severe hyperkalemia and rhabdomyolysis [5].

Urgency in recognizing airway obstruction and decisive surgical intervention

When instantaneous rigor leads to trismus, immediate alternative airway strategies are required. Prolonged attempts at conventional intubation can waste valuable resuscitation time [7]. In such cases, an early decision to perform an emergency cricothyrotomy is essential [8]. This case exemplifies the need for swift identification of airway obstruction and avoidance of unnecessary delays [9].

The role of emergency physician training in surgical cricothyrotomy

Emergency physicians must be proficient in surgical cricothyrotomy, especially in prehospital scenarios where standard airway management may be ineffective or unavailable [10]. Training should focus on early identification of cases where anatomical or pathological factors prevent intubation [11], hands-on practice with surgical cricothyrotomy to ensure familiarity with equipment and technique [12], and skill development through high-pressure simulations to enhance decision-making under stress [13].

Training on anatomically challenging patients: manikin vs. Cadaver models

Preparing for airway management in patients with extreme anatomical variations, such as morbid obesity, remains a significant challenge in medical training [14]. Standard airway manikins offer fundamental practice but often fail to replicate the complexities of managing an obese airway [15]. Effective training strategies include high-fidelity manikins designed to simulate obesity-related anatomical distortions, cadaveric training for a realistic tactile experience, and 3D-printed airway models that replicate specific challenges like excessive adipose tissue and obscured landmarks. Emphasis should be placed on incorporating ultrasound guidance and alternative techniques to improve anatomical identification in obese patients.

Conclusion

Instantaneous rigor is an uncommon but critical phenomenon that can unexpectedly complicate airway management. Physicians must be aware of this condition and avoid delays in securing an alternative airway when standard techniques fail. When necessary, surgical cricothyrotomy should be performed without hesitation. With the increasing prevalence of obesity, specialized training is essential for managing anatomically challenging airways. Future educational efforts should emphasize realistic simulation models that replicate real-world difficulties, ensuring preparedness and improving outcomes in critical airway emergencies.

Abbreviations

ATP	Adenosine triphosphate
BACT	Bougie–assisted cricothyrotomy technique
BMI	Body mass index
CPR	Cardiopulmonary resuscitation

DC	Difficult airway
EMS	Emergency medical services
ETT	Endotracheal tube
OHCA	Out–of–hospital cardiac arrest
ROSC	Return of spontaneous circulation

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References

1. Lee JH, Jung KY. Emergency cricothyrotomy for trismus caused by instantaneous rigor in cardiac arrest patients. Am J Emerg Med. 2012;30(6):e10141–2.
2. Pirch J, Schulz Y, Klintschar M. A case of instantaneous rigor? Int J Legal Med. 2013;127(5):971–4.
3. Esnault P, Prunet B, Lacroix G, D'Aranda E, Gaillard Y, Boret H. Instantaneous rigor after fatal Pholcodine intoxication. Br J Clin Pharmacol. 2014;77(3):578–9.
4. Bedford PJ, Tsokos M. The occurrence of cadaveric spasm is a myth. Forensic Sci Med Pathol. 2013;9(2):244–8.
5. Okada Y, Narumiya H, Kobayashi N, Nishimura H, Kotani H, Koike K, et al. Survival after cardiac arrest with instantaneous rigorlike stiffness: A case report. Ann Emerg Med. 2019;73(4):393–6.
6. Humar M, Meadley B, Cresswell B, Nehme E, Groombridge C, Anderson D, et al. Cricothyroidotomy in out-of-hospital cardiac arrest: an observational study. Resusc Plus. 2024;20:100833.
7. Sakles JC, Chiu S, Mosier J, Walker C, Stolz U. The importance of first pass success when performing orotracheal intubation in the emergency department. Acad Emerg Med. 2013;20(1):71–8.
8. Deakin CD, Nolan JP, Soar J, Sunde K, Koster RW, Smith GB, et al. European resuscitation Council guidelines for resuscitation 2010 sect. 4. Adult advanced life support. Resuscitation. 2010;81(10):1305–52.
9. Frerk C, Mitchell VS, McNarry AF, Mendonca C, Bhagrath R, Patel A, et al. Difficult airway society 2015 guidelines for management of unanticipated difficult intubation in adults. Br J Anaesth. 2015;115(6):827–48.
10. Mort TC. Emergency tracheal intubation: complications associated with repeated laryngoscopic attempts. Anesth Analg. 2004;99(2):607–13. table of contents.
11. Bair AE, Filbin MR, Kulkarni RG, Walls RM. The failed intubation attempt in the emergency department: analysis of prevalence, rescue techniques, and personnel. J Emerg Med. 2002;23(2):131–40.
12. Goumas P, Kokkinis K, Petrocheilos J, Naxakis S, Mochloulis G. Cricothyroidotomy and the anatomy of the cricothyroid space. An autopsy study. J Laryngol Otol. 1997;111(4):354–6.
13. Aziz MF, Healy D, Kheterpal S, Fu RF, Dillman D, Brambrink AM. Routine clinical practice effectiveness of the glidescope in difficult airway management: an analysis of 2,004 glidescope intubations, complications, and failures from two institutions. Anesthesiology. 2011;114(1):34–41.
14. Wang X, Wang Y, Zheng ZW, Liu YR, Ma WH. Ultrasound measurements for evaluation of changes in upper airway during anaesthesia induction and prediction difficult laryngoscopy: a prospective observational study. Sci Rep. 2022;12(1):18564.
15. Carlson JN, Wang HE. Updates in emergency airway management. Curr Opin Crit Care. 2018;24(6):525–30.

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