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Adrenaline Use in Anaphylaxis: Insights from a Case Series Study on Clinical Outcomes

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ABSTRACT

In this retrospective cohort case series at Jaslok Hospital and Research Centre, we examine the outcomes of adrenaline (epinephrine) use in anaphylaxis management. Anaphylaxis, a life-threatening systemic hypersensitivity, often presents with respiratory distress and/or hypotension. We analyzed three cases to illustrate epinephrine's critical role in diverse anaphylactic presentations. The study demonstrates the importance of timely epinephrine administration and the challenges in its use, emphasizing the need for clear guidelines and individualized treatment approaches. The findings highlight epinephrine's effectiveness in anaphylactic shock management and advocate for enhanced Physician's and supporting staff education on managing allergic reactions.

INTRODUCTION

Anaphylaxis stands as the most severe form of systemic hypersensitivity, presenting a life-threatening emergency characterized primarily by respiratory challenges and/or hypotension^[1]. This condition may also display various other clinical signs, which can be inconsistent across cases^[2]. The prompt and accurate identification and management of anaphylaxis are vital, as misdiagnosis, particularly by less experienced medical personnel, is a recognized risk^[3]. This underscores the necessity of first-line treatments that are effective and safe, even for those with limited experience. Epinephrine emerges as the cornerstone of anaphylaxis management, being the sole first-line treatment recognized for its rapid and comprehensive therapeutic impact on reversing anaphylactic symptoms and stabilizing mast cells. Current guidelines advocate for its intramuscular administration, reserving intravenous use for severe cases under the supervision of skilled clinicians^[4]. Immediate administration of epinephrine upon suspicion of anaphylaxis is critical to reduce morbidity and mortality. This intervention is unique in its capacity to address multiple organ system effects, including airway obstruction and shock, and delay in its use has been linked to fatalities in anaphylaxis cases^[5,6].

Administering epinephrine intramuscularly at a dosage of 0.01 mg kg^{-1} (maximum of 0.5 mg in adults) in the anterolateral thigh is the recommended protocol. Intravenous administration is advised for patients who do not respond to intramuscular epinephrine and IV fluids, or in situations of cardiovascular collapse^[7,8]. However, tendencies to over-diagnose anaphylaxis, leading to excessive adrenaline use, have been observed in some healthcare groups. Furthermore, there is a noted reluctance among medical professionals to utilize adrenaline in anaphylaxis management, which emphasizes the need for accurate diagnosis and enhanced training in this area^[9].

This study aims to clarify the existing uncertainties regarding the appropriate dosage, concentration, and route of adrenaline administration for anaphylaxis treatment. Primary objectives focus on providing frontline healthcare providers with clear, practical guidelines for epinephrine administration, considering the dynamic nature of symptoms in severe allergic reactions. A secondary objective is to re-evaluate the prevalent hesitations regarding the use of intravenous adrenaline in critical anaphylaxis cases, challenging the base of these concerns and exploring other contributory factors to cardiovascular complications during anaphylactic events.

MATERIALS AND METHODS

This retrospective cohort case series is designed to examine the clinical outcomes arising from adrenaline use in anaphylaxis cases. We focused on patients who

sought medical care at Jaslok Hospital and Research Centre and exhibited symptoms indicative of anaphylaxis. The study includes a comprehensive review of cases, during which we gathered and analyzed data from three distinct patients who visited Jaslok Hospital and Research Centre. These patients were selected based on their presentation of anaphylaxis symptoms, providing a focused lens through which to assess the effectiveness of adrenaline in treating this severe allergic reaction.

Case presentation:

Case 1: A 55-year-old hypertensive female presented to the emergency room exhibiting symptoms of restlessness, difficulty breathing, and severe weakness. Initial evaluation revealed stable airway and breathing metrics, with SpO₂ at 98% and respiratory rate at 30. Circulatory assessments showed a heart rate of 110 bpm and blood pressure of 100/60 mmHg. Other vital signs, including Capillary Refill Time, Blood Glucose, and Glasgow Coma Scale, were within normal limits. An ECG indicated sinus tachycardia.

As the patient's condition worsened, evidenced by a blood pressure drop to 80/60 mmHg, IV fluid boluses were administered. The patient had taken an antibiotic earlier, correlating with symptom onset. Initial hesitation in diagnosing anaphylaxis led to the administration of Avil and hydrocortisone. However, due to persistent symptoms and fitting anaphylactic shock criteria, 0.5 cc of adrenaline was administered IM, resulting in rapid blood pressure stabilization. The patient was then admitted to the ICU, where subsequent tests showed normalization of initial hyperlactatemia.

Case 2: A 75-year-old female was brought to the ER from the endoscopy room with sudden hypotension. Initial assessments showed stable airway and SpO₂ at 99%, but a significantly low blood pressure of 70/50 mmHg. After establishing IV access and administering fluid boluses, her condition did not stabilize. The patient had experienced melena and undergone an endoscopy, which revealed a pre-procedure hemoglobin level of 10 g dL^{-1} . Lab tests, including ABG, indicated hyperlactatemia.

The patient's condition deteriorated post-IV iron administration and restroom use. Initial administration of Avil and hydrocortisone was ineffective. Progression to IM adrenaline, followed by IV adrenaline, led to an improvement in blood pressure. Noradrenaline was subsequently tapered and stopped. The patient, having avoided hypovolemic shock, recovered post-ICU admission and was later discharged.

Case 3: A 60-year-old male with a known history of multiple allergic reactions presented in the ER with facial edema. Despite initial treatment with Avil and

Hydrocortisone as recommended by his consultant, there was no significant improvement. Recognizing the severity of the edema and the ineffectiveness of standard treatments, intramuscular adrenaline was administered. However, the patient did not respond to three repeated doses of intramuscular adrenaline, as he was in anaphylactic shock. Consequently, a decision was made to administer adrenaline intravenously in a 1:10000 dilution. From this dilution, 0.1 mL (equivalent to 0.1 mg of adrenaline) was drawn into an insulin syringe and administered to the patient. Following this intravenous adrenaline treatment the patient showed marked improvement. After a period of stable observation in the ER, he was admitted to the Intensive care unit with detailed instructions for follow-up care and management of future allergic reactions.

DISCUSSIONS

Epinephrine, also known as adrenaline, remains the definitive first-line treatment for anaphylaxis, exerting its life-saving effects by activating alpha and beta-adrenergic receptors. This dual action results in vasoconstriction, increased peripheral resistance, diminished mucosal swelling, cardiac enhancement, bronchodilation and inhibition of mediator release from mast cells and basophils, as facilitated by cyclic adenosine monophosphate signaling. The intramuscular route is recommended for rapid absorption, particularly in the deltoid or anterolateral thigh regions, as affirmed by several studies (Alrasbi 2007, McLean Tooke 2003; Simons 2004) and is integral to swift anaphylaxis management (10,11,12,13). The case analyses presented herein illuminate the pivotal role of adrenaline in anaphylaxis management, underscoring the necessity for clear, comprehensive guidelines for healthcare providers. Each case demonstrates varied symptomatology, indicative of the diverse clinical spectrum of anaphylaxis. While intramuscular injections are commonly recommended, certain cases necessitate the use of intravenous adrenaline, especially when IM injections are ineffective. For intramuscular injections, the recommended dose is 0.01 mg kg^{-1} , up to a maximum of 0.5 mg. In contrast the intravenous administration should start with a dilute solution of 100 micrograms (0.1 mg) over 5-10 min, followed by a continuous infusion starting at 1 microgram/minute, titrated to effect. [2-7].

Case 1 underscores the criticality of recognizing anaphylactic shock, even in the absence of clear allergens. The patient's stabilization following the timely intramuscular administration of adrenaline reinforces the need for prompt identification and intervention in such scenarios. In Case 2, a patient experienced sudden hypotension post-endoscopy.

Initial reluctance to administer adrenaline, stemming from uncertainties regarding its appropriateness, was overcome, leading to improved patient outcomes following adrenaline administration. This case accentuates the ramifications of delaying adrenaline use in severe anaphylaxis and the importance of adhering to treatment protocols. Contrasting the receptor affinity, epinephrine acts more potently on both alpha and beta receptors compared to norepinephrine, which primarily affects alpha receptors with a milder effect on beta receptors [14,15].

Case 3 details the challenges in managing a patient with a history of recurrent allergic reactions. The standard regimen of antihistamines and corticosteroids was initially ineffective. The subsequent administration of adrenaline intravenously in a 1:10000 dilution proved effective, demonstrating the critical role of IV adrenaline in severe cases where IM injections are inadequate. This case particularly underscores the importance of considering IV adrenaline as a viable option when IM administration fails to yield the desired response [7,16].

A 1995 study in Munich, Germany, reviewing emergency physician responses to severe anaphylaxis cases, found that while all 70 patients survived, only 10% were provided with future management guidance or an emergency kit [17]. For milder reactions (grade I), glucocorticoids and antihistamines were deemed appropriate [18,19].

CONCLUSION

The case series demonstrates the heterogeneity of anaphylaxis presentations and reaffirms adrenaline as a versatile and potent agent in its management. The appropriate administration of adrenaline, particularly the judicious use of the intravenous form, is critical in stabilizing patients when intramuscular adrenaline is ineffective. It is crucial for healthcare providers to be well-versed in both routes of administration, recognizing when to escalate to intravenous adrenaline and the correct dosing protocols. This knowledge, coupled with vigilant monitoring, can prevent serious outcomes in anaphylactic emergencies. Furthermore, comprehensive training for healthcare providers on the nuances of adrenaline use in anaphylactic management, including the initiation of an intravenous infusion when bolus injections are unsuccessful, is essential for improving patient outcomes.

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