



Case Report

Management of Accidental Epinephrine Injection by an Expired Auto-Injector in Emergency Department Using Phentolamine: A Case Report

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Abstract

Background: In recent years, there has been a notable rise in reported incidents of accidental auto-injection by epinephrine auto-injectors following their widespread adoption in prehospital settings. The management of such incidental injections has become a topic of controversy. **Case Presentation:** A 30-year-old male paramedic presented with right thumb pain and skin discoloration after accidentally injecting himself with an epinephrine autoinjector (EpiPen®). The patient was treated with phentolamine (1.5 mg), which was diluted in 1 ml of 2% lidocaine and administered via injection near the affected site. The patient's skin color changed to pink immediately after the treatment. He was discharged with a complete recovery, and his thumb returned to its baseline status prior to the incident. **Conclusion:** Phentolamine effectively managed thumb ischemia after an accidental expired EpiPen injection, despite concerns about side effects. However, the literature lacks well-established protocols for handling such cases. The development of a robust framework and enhanced training for healthcare providers, patients, and caregivers is strongly recommended to prevent similar incidents and improve overall care quality.

Keywords: Accidental Injection; Autoinjector; EpiPen; Epinephrine.

Introduction

In anaphylaxis management, time plays a critical role due to the unpredictable and potentially fatal nature of the condition if not addressed promptly. Epinephrine is the preferred treatment [1], and any delay in its administration can be linked to a higher likelihood of mortality [2]. To mitigate this issue, the epinephrine auto-injector was developed for utilization in pre-hospital settings by patients, caregivers, or paramedics. The device was designed

to dispense a single dose of epinephrine, gaining widespread acceptance from the public due to its convenience and safety, as well as its few side effects [3].

The increasing prevalence of epinephrine auto-injector dispensing has led to a concurrent rise in unintentional epinephrine injections. Statistical analysis reveals that the occurrence rate is approximately one instance per 50,000 EpiPen® units dispensed [4].

The global rise in unintentional auto-injections can be attributed to insufficient education for healthcare professionals

and patients regarding proper device utilization and the potential hazards associated with incorrect administration [5]. Unintentional injections of epinephrine autoinjectors (EAI) can happen in various situations, such when the device is unintentionally held in an inverted position and thumb is rested on the extremity during the application process [6-8]. Epinephrine, a hormone predominantly secreted by adrenal glands, plays a crucial role in the human fight or flight response. Its primary impact on the skin transpires through binding to alpha-adrenergic receptors, specifically alpha-2 receptors, resulting in arterial constriction and subsequently diminishing blood flow to the skin which may lead to ischemia and tissue necrosis. However, after examining data from Texas Poison Center Network on 365 unintentional injections over a period of six years, there were 365 epinephrine injections to the hand and all patients had complete resolution of symptoms without hospitalized, hand surgeon evaluation or surgical care and there were no reported significant systemic effects [9]. A comprehensive systematic review revealed that more than 99% of patients who experienced unintentional injections with adrenaline autoinjectors eventually achieved complete recovery [10].

The purpose of this study is to present the case of a 30-year-old paramedic who accidentally injected an epinephrine auto-injector into his right thumb. We analyze the results of this incident and refer to relevant literature to outline the treatment approach used.

Case Presentation

A 30-year-old paramedic, who was brought to the emergency department by the red crescent, experienced right thumb pain and skin discoloration after accidentally injecting himself with an expired epinephrine auto injector EpiPen®. The incident occurred at 20:00, right at the end of his shift, while he was counting his medication for item check prior to the handover. During this time, the auto-injector discharged its contents, which included 300 micrograms of 1:1000 epinephrine, into the distal end of his right thumb.

Following the incident, he was promptly transported to the emergency department via ambulance. Approximately 30 minutes post-incident, he underwent evaluation by the emergency medical team and was situated in the resuscitation area. The subject reported mild discomfort in the right thumb, but did not experience palpitations, chest pain, or respiratory difficulty. While conscious, alert, and oriented, the individual exhibited anxiety. The subsequent examination indicated:

- Normal vital signs.
- A clear chest examination.
- Inspecting the right thumb: widespread bluish discoloration encompassing the nail bed, a minor puncture wound on the

palmar aspect of the thumb's tip, delayed capillary refill (4 seconds), and an absence of tenderness or crepitus. (Figure 1 and 2)

- Normal coloration of remaining fingers with a 2-second capillary refill time.
- There was a noticeable pallor present on the right arm and forearm, which followed the distribution of the underlying vasculature.
- Unremarkable power and sensory examination of both upper limbs.



Figure 1: Before the treatment, Right thumb was pale and nailbed was dark in colour.



Figure 2: Before the treatment, Right thumb was pale with clear puncture wound.

The patient reassured by emergency medicine team and was advised to maintain his thumb in a downward position. A solution of 1.5 mg Phentolamine diluted in 1 ml of 2% Lidocaine was

administered in close proximity to the initial injection site, resulting in an immediate color change to pink (Figure 3 and 4). The patient underwent a 2-hour observation period, during which the plastic surgery team evaluated him, noting full recovery of the baseline status of the thumb prior to the incident. Following a subsequent asymptomatic period of 2 hours, the patient was discharged in stable condition. Several weeks subsequent to the initial observation, he was reached via telephone and reported experiencing a total absence of symptoms, revealing no cause for concern.



Figure 3: After the treatment: Right thumb was pink.



Figure 4: after the treatment: the palmar surface of the thumb was pink and looked similar to the noninjured thumb.

Discussion

The popularity of epinephrine autoinjectors has grown in response to increased allergies to variable subjects particularly food, increased public awareness, and recognition of anaphylaxis [11]. This has consequently led to a rise in the incidents of unintentional injections by patients and care providers. Mathez et al.'s [5] research revealed that 16% of physicians who studied the instructions for the Epipen® device mistakenly administered the Epipen® trainer to themselves.

In the available literature, there have been no significant long-term consequences reported for accidental injections of epinephrine. Additionally, no permanent sequelae have been identified from unintentional injections of epinephrine via auto-injectors. The majority of patients who experienced such incidents did not require specific treatment and saw their symptoms resolve within a period of 2 to 24 hours post-injection [11]. Considering the nature of the injuries, randomized control trials may not always be feasible. In such cases, treatment modalities can be derived from case reports and observations, which can provide valuable insights into effective approaches. It is important to acknowledge that the management of such cases has been variable, with the utilization of both pharmaceutical and non-pharmaceutical modalities. However, the outcomes have also been inconsistent in terms of the time required for complete recovery, the success rate of the treatment, and the possibility of permanent or long-term sequelae. The most commonly used drugs for vasodilation are topically applied nitroglycerin paste or a nitroglycerin patch, locally injected terbutaline (a beta-adrenergic receptor agonist), and locally injected phentolamine (a non-selective alpha-adrenergic receptor antagonist) [10]. These drugs work by reducing vasoconstriction and promoting vasodilation. Nitroglycerin converts to nitric oxide, a powerful vasodilator, while terbutaline and phentolamine individually act to reduce vasoconstriction. It is important to note that phentolamine also reverses the vasoconstriction brought on by epinephrine [10], and aids in alleviating the related discomfort and complications. Studies have demonstrated that phentolamine effectively reduces the duration of symptoms caused by vasoconstriction. Both Velissariou et al. [12], and Aljahany M.S. et al. [13] observed positive results, despite variations in dosages and regimens utilized. In our study, we observed similar outcomes, with local phentolamine administration effectively facilitating the rapid reversal of patient symptoms and ultimately resulting in complete recovery. This highlights the potential benefits of using phentolamine in managing adverse reactions related to epinephrine administration.

Topical vasodilators, specifically topical calcium channel blockers and topical nitroglycerin, are regarded as alternative, less invasive treatment options. Although these methods have been utilized to a limited extent, they have demonstrated efficacy in certain cases [13]. Regarding Patients who received Topical Nitroglycerin particularly a few exhibited a response within an hour, while others demonstrated a delayed recovery up to one month [13]. However, numerous studies have indicated its ineffectiveness [14]. Applying a digital block with local administration of Lidocaine has been documented to alleviate sympathetic afferents in the digit, but results have varied across studies [5,14]. Despite the variable treatment modalities, observation and spontaneous resolution of symptoms have been reported [15]. Pain and anticipation of worsening ischemia can influence physicians' management

decisions. In this particular approach, it has been observed that there is an increased severity in reperfusion pain experienced by patients. Additionally, a prolonged return of sensation can be noted, which may take up to 10 weeks to fully recover [14].

Conclusion

In this case report, phentolamine was used effectively and elicited a rapid response. Its use in managing thumb ischemia after an accidental injection with an expired EpiPen has been supported by various accumulated reports. Although, concerns about local pressure effects, arrhythmia, and hypotension have been raised, these side effects have not been reported previously. Consequently, phentolamine must be given priority in situations involving accidental administration of Epinephrine injections. It is evident that despite the growing number of incidents of EpiPen injection, literature remains deficient in well-established protocols for managing such cases. It is strongly recommended to utilize available data to develop a robust framework and enhance training through safe, evidence-based methods for healthcare providers, patients, and their caregivers. This will help prevent the recurrence of similar incidents and bolster the overall quality of care delivered.

Conflict of Interest: None declared.

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Consent: The patient's involvement in the research study was voluntary, and his participation was not compelled or forced. And was consented to the shar of his clinical information and hands photographs for educational purposes. However, there was no personal information or identification methods used, and his personal data remained secure.

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