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Case Report

Accidental Administration of Auto-Injectable Adrenaline into a Digit

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Accidental Administration of Auto-Injectable Adrenaline into a Digit

Abstract

Dental Practitioners (DPs) and Dental Care Professionals (DCPs) have a duty of care to ensure patient safety is at the forefront of their clinical practice. Medical emergencies, although rare, can occur in the dental setting, and early, effective management of these emergencies can, not only save lives, but also improve long-term outcomes. We report a case which highlights a safety incident involving accidental self-administration of an adrenaline autoinjector (AAI) into a digit during a medical emergencies training session. Consequently, we wish to raise awareness of these unexpected safety incidences and propose a protocol for the treatment of such injuries.

Clinical Relevance Statement

This paper is to highlight the importance of vigilance when undertaking a medical emergency training course, and the introduction of a new protocol to be used in cases of accidental AAI injury.

Objectives

The reader should understand the implications of accidental AAI injury and the importance of safety within a medical emergency training setting.

Introduction

Medical emergency training in dentistry is paramount, and is an essential part of both undergraduate teaching, and a recommended postgraduate core subject in continued professional development (CPD) outlined by the General Dental Council (GDC).¹ Anaphylactic reactions to drugs used in dentistry, or substances found in dental settings, are well-reported.² The most commonly described anaphylaxis in the dental setting is to antibiotics³, however chlorhexidine allergies, although rare, are on the rise⁴, however the incidence is unknown.⁵ Its extensive use to reduce infection has potentially sensitised a small portion of patients leading to life-threatening anaphylaxis on exposure.⁶ Due to the possibility of anaphylaxis in the dental setting, it is imperative that dental care providers should have up-to-date training and should feel confident in the use of AAls when needed.

Adrenaline is the gold standard for the management of anaphylaxis⁷ and the prescription of AAls is commonplace across the world. The European Academy of Allergy and Clinical Immunology released guidelines in 2014 for prescribing AAI.⁸ Although clinicians are advised to deliver an intramuscular dose of 0.5mg of 1:1000 for adults, the EpiPen[®] delivers a lower single dose of 0.3mg of 1:1000. The doses differ with age for those under 16 years of age. This allows patients to manage their reactions immediately and then summoning medical assistance. It also allows healthcare professionals in remote locations or those in non-acute medical environments to have pre-loaded syringes to manage medical emergencies appropriately. Drawing up adrenaline in a medical emergency situation in the correct dose using a hypodermic needle and syringe is thought to be more difficult than using an auto-injector, potentially risking spillage of the drug, incorrect dose administration, self-injury due to breaking vials⁹ and therefore potential contamination of the drug. This is thought to be even more likely for DPs and DCPs who are unlikely to be drawing up medications from glass vials on a regular basis unless treating patients under intravenous sedation.

The use of pre-filled syringes and AAI is encouraged for use by Dental Practices as advised by the GDC and Resuscitation Council, UK¹⁰. However, a recent reminder (9th October 2018) to healthcare professionals from the Chief Dental Officer, England states that due to shortage of AAI and the need to keep them within the community setting, DCPs are asked to replace AAI for ampoules when renewing adrenaline in their medical emergency kits.¹¹

DPs and DCPs are required to undergo training in the use of AAI pens but should also be competent to draw up and administer 0.5mL of 1:1000 adrenaline from ampoules with a normal syringe and needle for intra-muscular administration. The British National Formulary¹² advises that half doses of adrenaline may be safer for patients who are taking Amitriptyline, Imipramine and Beta-Blockers.

Due to the fact that anaphylaxis is rare in the dental setting, DPs become de-skilled in the use and administration of AAI. The Department of Health notes that “wrongly prepared high risk injectables” is a Never Event.¹³ Consequently, it is essential during medical emergency training that dental teams are not only taught on the correct preparation of intra-muscular adrenaline, but also in the correct use of pre-prepared adrenaline, such as EpiPen[®].

We report a case of inadvertent self-administration of AAI into their thumb whilst on a postgraduate medical emergencies training course. This was considered a Serious Incident (SI), and consequently the trainers and educators should be mindful that such SIs may occur during training sessions, and thus should be trained in managing them. At present there are no guidelines regarding this, and therefore we suggest this should be taken into consideration when developing medical emergency training courses.

Summary of Case

A 36-year-old male who was otherwise fit and well, whilst undergoing training in anaphylaxis managed to discharge the EpiPen[®] into his right thumb. He

immediately informed the trainer as to the incident. Figure 1 shows the right thumb was pale compared to the left non-injured thumb. Initial examination revealed no evidence of capillary refill, the digit was insensate. He was advised to seek urgent care at the nearest Emergency Department (ED). He reports being seen, and after some deliberation and searching of the internet by ED staff, Phentolamine; a reversible alpha-adrenergic antagonist which reverses the effects of adrenaline, was administered into the digit which proved effective.

Within a few hours the main symptoms resolved but for a few days afterwards he had altered sensation in the thumb which caused some discomfort. The symptoms after three months have completely resolved and there appears to be no long lasting or permanent effects.

Discussion

The first reported cases of injection of adrenaline into a digit was by Jordan in 1969¹⁴ where a dental assistant deliberately injected adrenaline into her finger to stop bleeding from a laceration. She developed blanched cold digit. Two hours afterwards she immersed it into warm water, but this had no effect. Amyl-nitrite inhalations were attempted but to no avail, but when 5ml of Phentolamine was injected circumferentially around the finger there was instant return of spurting arterial blood from the original injury.

Anecdotally, Denkler¹⁵ reported a case of digital necrosis after adrenaline-containing local anaesthetics, although most of these relate to times when the concentration of adrenaline was unpredictable. It is still taught that adrenaline is not safe to be used with local anaesthetics in peripheries such as digits, nose and ears due to the vasoconstrictive effect of the adrenaline and the risk of vascular insufficiency or, at worst, necrosis of the structure. However, there are reports showing that its use in surgery of the digits is safe and effective¹⁶.

There have been reports of a variety of treatment options which include administration of nitroglycerine (a potent vasodilator), topically and systemically, infiltration of phentolamine locally and regionally, proximal intra-arterial

injection, digital sympathectomy via a digital block, and systemic or topical calcium channel blockers¹⁷. Phentolamine administered topically in a rat tail arterial model has resulted in complete relief of adrenaline induced vasospasm¹⁸. It is a short acting reversible competitive inhibitor of α_1 and α_2 adrenergic receptors. The side effects of systemic administration of Phentolamine include hypotension, reflex tachycardia, arrhythmias and cardiac ischaemia¹⁹. Delivery of the drug through local or regional infiltration at low doses reduces the risk of these potentially significant side effects. Phentolamine appears to be the most common treatment of choice for the accidental injection of adrenaline. It is recommended, although not licensed, to infiltrate locally 2-2.5mg phentolamine mesylate at the puncture site as soon as possible. Small volumes should be used, for example 1 to 2 mLs, however due to its short half-life the treatment may need to be repeated. Resolution of the signs and symptoms usually occurs within 60 minutes.

The profession of this patient may have swayed the attending emergency doctor to actively treat him, rather than manage this conservatively as the low risk of digit necrosis could impact significantly on the patients' profession. On reviewing the literature, there appear to be no case reports of confirmed digit necrosis, irrespective of active or conservative management.

Summary

It has become evident from the literature²⁰, and is also highlighted in this case, that the cause of potential accidental self-injection is in the incorrect holding of the auto-injector pens. They should be held with a fist grip, as in Figure 2 so that when removing the end, one's thumb is away from the dispensing end, and hence the discharging of the needle is into the patient, and not into the clinicians' thumb pad.

This case reinforces the need for careful instruction when teaching with 'live' equipment, and the need for an awareness of the risks associated with such training, highlighting the need for protocols for treatment. Furthermore, one

should consider the use of AAI training device (Figure 3), which contains no medicine, and no needle, when training for medical emergencies. We propose a simple to follow safety protocol flowchart to be used for any accidental AAI injury in medical education training (Figure 4).

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Consent

All parties involved have consented to publication of this article.

Conflicts of Interest

There are no conflicts of interest.

Figures Included

Figure 1:

Photograph of delegate's right thumb minutes after inadvertently administering AAI into it

Figure 2:

Correct handling of AAI device

Figure 3:

Example of a training AAI device

Figure 4:

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