ACCIDENTAL INTRAVENOUS ADMINISTRATION OF EPINEPHRINE: CASE REPORT AND LITERATURE REVIEW

Running title: Accidental Epinephrine Administration

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RESUMO

A administração intravenosa acidental de adrenalinha é um erro raro mas potencialmente fatal. Descrevemos um caso de uma mulher de 74 anos que durante uma intervenção cirúrgica a uma Coelitíase recebeu por acidente 4mg de adrenalinha intravenosa em vez de Neostigmina, no despertar da anestesia.
A doente apresentou um episódio de Taquicardia Supraventricular (TSV) juntamente com uma crise hipertensiva e sinais de perfusão periférica fracos.
O tratamento adequado resultou numa recuperação favorável sem sequelas.
Discutimos a gestão adequada desta complicação e possíveis mecanismos para evitar erro humano na administração de fármacos durante a anestesia.

Palavras Chave: Adrenalinha, Overdose, Acidentes.

SUMMARY

Accidental Intravenous administration of epinephrine is a rare but potentially lethal mistake. We describe a case of a 74 year-old woman that during an uneventful surgical intervention for cholecystitis received, by accident, 4 mg of intravenous epinephrine instead of neostigmine during the emergence from anaesthesia.
The patient presented an episode of supraventricular tachycardia (SVT) along with an hypertensive crisis and signs of poor peripheral perfusion. Appropriate treatment resulted in a favorable outcome with no sequelae.
We discuss the proper management of this complication and possible mechanisms to avoid human mistakes in drug administration during anesthesia.

Keywords: Epinephrine, Overdose, Accidents.

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Case history

A 74-year-old female (body weight of 80 Kg.), with a past medical history of hypertension, transitory ischemic attacks and hypercholesterolemia, was diagnosed with cholelithiasis. A laparoscopic cholecystectomy, under general anaesthesia, was indicated. The patient was medicated with lorazepam 1 mg PO the night before and on the morning of the intervention. Baseline parameters measured in the operating room, pre-induction, revealed an arterial pressure (AP) of 140/80 mmHg, a heart rate (HR) of 70 bpm and Oxygen saturation (O2sat) of 99% at room air. Induction was performed with intravenous fentanyl (0.1 mg) and propofol (180 mg). After this, 7 mg of vecuronium were administered and orotracheal intubation was performed easily, followed by intermittent positive pressure ventilation. Anaesthesia maintenance was done with oxygen 50% in air and sevoflurane 2%. A nasogastric tube was inserted before a pneumoperitoneum was done. Laparoscopic cholecystectomy was performed uneventfully in about 1 hour. During the emergence from anaesthesia, signs of residual curarization were observed and it was decided to administer IV neostigmine (2 mg) and atropine (1 mg). One minute later the patient presented with supraventricular tachycardia (HR of 144 bpm), AP of 205/125 mmHg, and peripheral cyanosis. Given the temporal sequence of the drug administration and the clinical scenario, the ampoules of drugs used to reverse curarization were reviewed. It was confirmed that accidentally 4 mg of epinephrine had been administered instead of 2 mg of neostigmine. After recognition of the accidental administration of epinephrine, FiO2 was increased to 100%, anaesthesia was intensified with sevoflurane, and labetalol 30 mg (10 mg bolus q 4 minutes) was administered, achieving hemodynamic stability in 25 minutes. Arterial blood gases immediately after the episode revealed 0.Sat of 97% with a mild respiratory acidosis (pH 7.30; PCO2 49.7 mmHg). All parameters were back to normal limits in a second evaluation 40 minutes later.

Once the patient was recovered and stable, the tracheal tube was removed. She was transferred to the recovery room where she was closely monitored and serial determinations of cardiac enzymes were performed, not revealing any abnormality. Five hours after clinical stability was achieved, the patient was transferred to the surgical ward. In the next 72 hours, physical examination and serial analytical determinations remained within normal limits and the patient was discharged with no apparent sequelae.

After analyzing this accident, we found several risk factors: the syringe was not labelled; there was no double confirmation before drug administration; the ampoules of epinephrine and neostigmine were close to each other in the anaesthesia trolley and they had very similar sizes, colours and labels (Fig. 1).

Discussion

Human errors are part of potential complications associated with drug therapy. Anaesthesia is a discipline where this issue is especially critical given the type of drugs used and the clinical context. Mistakes in the administration of drugs represent a relevant issue with estimated rates of this phenomenon in the range of 49%. Therefore it is a priority to minimize the incidence of drug therapy errors in anaesthesia in order to avoid the potentially dramatic consequences in some circumstances. Here we describe a case report of an erroneous administration of a high dose of epinephrine, during the emergence phase of an otherwise uneventful cholecystectomy under general anaesthesia. Management of this complication and possible strategies to decrease its incidence are discussed.

Erroneous IV administration of high doses of epinephrine is considered a rare complication in the medical literature with just only a few cases communicated. However it can occur in different clinical scenarios and it might have dramatic consequences because of the cardiotoxicity of epinephrine. It is critical to recognize it and to be familiar with the physiology of this phenomenon in order to manage it properly. Within seconds of IV administration of high doses of epinephrine, patients present with diaphoresis, high arterial pressure, tachycardia, tachypnea, tremor and peripheral cyanosis. When patients are not under general anaesthesia, they can refer anxiety, nausea and chest pain. Within minutes the clinical scenario can evolve to heart failure, cardiogenic shock, myocardial infarction, pulmonary edema, pulmonary hemorrhage, renal failure or even cardio-respiratory arrest. Frequently, elevated cardiac enzymes are observed as well as metabolic acidosis, hypokalemia and rhabdomyolysis. The pathophysiology of these toxic effects is explained by two mechanisms: first, high catecholamine concentration leads to a decrease in intracellular glutation and therefore an accumulation of highly toxic reactive oxygen radicals. Secondly, self oxidation of epinephrine and other catecholamines induces production of aminocromes that
results in tissue damage and fibrosis. Moreover, the potent alpha/beta adrenergic stimulus can cause cardiovascular failure.

Treatment of this complication is based on the severity of the different signs and symptoms observed. After becoming aware of the erroneous drug administration, a first assessment [as per the ABC criteria] should take place, followed by assisted ventilation with FiO2 100% and orotracheal intubation (if not previously). IV Labetalol is an excellent choice because it has beta-blocking effect (beta1/beta2) and alpha antagonism (beta>alpha); 5-20 mg intravenous boluses injected over two minutes can be administered (maximum adult dose of 200 mg). IV labetalol acts in 5-30 minutes and has a duration of action of 50 minutes. If established hemodynamic instability after epinephrine administration, invasive arterial pressure and central venous pressure monitoring should be performed. It is also critical to keep a proper hydration and electrolyte balance, with special caution to the patient’s volume status. Other drugs, like nitroglycerine, morphine or furosemide, could be required in the event of hypertension, pulmonary edema or angina. Moreover, management of other potential complications, such as severe renal failure, metabolic acidosis and ventricular arrhythmias, is needed in some circumstances.

In spite of the several reviews and databases available in literature about drug administration errors, their incidence is most likely underestimated, since in only a minority of cases are these mistakes actually reported. The Australian Incident Monitoring Study reported 144 incidents in which the "wrong drug" was nearly or actually administered to a patient; in more than 70% of all reports, ampoules or syringes were involved. The risk factors identified were: similar appearance of syringes and ampoules, drug labelling error, inattention, haste, fatigue and communication failure.5,11 Inta and co-workers estimated that 4.3% of the critical incidents as a result of drug administration errors in the operating room, are related to syringes or ampoules swap. Most of the cases of erroneous drug administration have no dramatic consequences, but in up to 1% they could be potentially fatal. A number of measures and/or strategies have been proposed to avoid this type of mistakes such as: colour coding of selected drug classes for both syringes and ampoules; fluent communication with nursing team; double confirmation before drug administration; automated identification devices to prevent patient misidentification; workload-time pressure reduction; adequate training of the staff; rechecking equipment and monitors capable of detecting the incident; guidelines improvement; avoiding interruptions during drug preparation and use of standardised drug storage.13

Our case illustrates an unusual complication in drug administration that could have had fatal consequences if not recognized early and managed properly.


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