

## Case Report

# Fatal Ventricular Arrhythmias after Local Adrenaline Infiltration during a Case of Hemithyroidectomy

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## Abstract

Skin infiltration of adrenaline is a common practice in ENT surgeries and has been in use for many years to provide hemostasis. However, accidental intravascular injection of adrenaline can result in adverse cardiovascular effects, such as arrhythmias, pulmonary oedema, and even cardiac arrest. We report a case of adrenaline-induced hypertensive crisis followed by ventricular tachycardia due to subcutaneous infiltration of 1: 200,000 adrenaline in 2% lignocaine solution in a patient undergoing thyroid lobectomy procedure. We successfully provided advanced cardiac life support in the operating room and cardioverted the patient back into a sinus rhythm with no untoward effects and completed the surgical procedure. The patient recovered without any apparent sequelae after intensive care.

## INTRODUCTION

For most ENT surgeries, pre-surgical local infiltration with adrenaline is a time tested and widely used practice. Adrenaline, with or without local anaesthetic, is infiltrated for its useful properties as a hemostatic agent, constricting capillaries and providing a better visualisation of surgical field. When used with local anaesthetic agent, adrenaline delays its absorption and hence toxicity of agent [1].

Adrenaline however, can lead to potential adverse effects, such as hypotension, hypertension, tachycardia, and arrhythmias. The hemodynamic effects of adrenaline are dose-dependent and different dose adrenaline may activate different types of sympathetic receptors. Systemic absorption of locally infiltrated adrenaline causes widespread hemodynamic effects which are variable in different patients and are related to its blood concentrations. Various studies have shown that the hemodynamic changes after local infiltration of adrenaline depend on physical status of the patient, adrenaline dose used, vascularity of the site of administration and its rate of absorption from the area infiltrated. Many reports have shown that injection of adrenaline, even in therapeutic doses, can lead to increased heart rate and arrhythmias in susceptible patients. The incidence of cardiovascular toxic adverse effects has been shown to increase in a dose dependent manner [2].

## CASE REPORT

A 45 years old, hypertensive, female of ASA PS class II, weighing 65 kg, was posted for thyroid lobectomy for papillary carcinoma

right lobe of thyroid. Pre-anaesthetic evaluation revealed that the patient was a known case of hypertension on tab. Amlodipine 5 mg for 3 years. General and Systemic examination was normal with stable vital signs. Airway assessment was also normal with MPS Grade-2. All laboratory investigations including CBC, LFTs, KFTs, serum electrolytes, fasting blood sugar and thyroid profile were within normal values. 12-lead ECG showed normal sinus rhythm with a heart rate of 90 bpm and Chest X-ray was also normal. Echocardiographic evaluation revealed a normal heart.

In the operating room, routine monitoring included 3-lead ECG, NIBP and Pulse oximetry and end tidal capnography (etCO<sub>2</sub>). Baseline vitals (BP-130/80 mmHg, HR of 90 bpm, and SPO<sub>2</sub> of 98%) were recorded and intravenous access was established with 20G intravenous cannula. Patient was Premedicated with Injection pantaprazole 40 mg and Injection fentanyl 60 µg intravenously. Induction was performed with injection Propofol 120 mg and Atracurium 35mg and endotracheal intubation was carried out after adequate muscle relaxation. Anaesthesia was maintained with N<sub>2</sub>O/O<sub>2</sub> in a 50:50 mixture and Isoflurane (1%). The anaesthetic depth was adequate as the vital parameters were stable and the patient was receiving approximately a total MAC of 0.8-1.2% of inhalational agent. After surgical draping and painting, ENT surgeon performed local infiltration of neck around the tumor site with 4 ml of 2% Xylocaine and adrenaline (1:200,000) after checking the negative blood aspiration. Between 5 to 10 minutes after the local infiltration and as soon as the surgical procedure was underway, the heart rate suddenly increased to 170 bpm and the blood pressure recording was 239/135 mmHg. Simultaneously, ectopic ventricular beats

appeared on the electrocardiographic tracing and continued into a monomorphic ventricular tachycardia. Immediately, the surgical procedure was stopped and we turned off all anaesthetic gases and ventilated the patient with 100% O<sub>2</sub> only. Injection Xylocaine 100mg was given i/v but there was no response and the arrhythmia continued as sustained ventricular tachycardia even after the second dose of Xylocaine 100 mg i/v. As radial pulse was absent, external cardiac compressions were started followed by an attempt of synchronised DC shock of 120 joules which failed and chest compressions were continued. A second DC shock of 150 joules was given and patient was successfully cardioverted to sinus rhythm. The heart rate stabilised to the sinus tachycardia of 110-120 bpm and blood pressure reading to 130/90 mmHg. Meanwhile a cardiologist was called who advised to watch for deterioration and repeat arrhythmias. However, no further arrhythmias were seen. After the cardiac rhythm of the patient became normal, surgical procedure was restarted and completed without further events. It took about one and a half hours to complete hemithyroidectomy and the patient was successfully extubated at the end of the procedure after giving reversal. After extubation, patient was conscious, oriented maintaining stable vital signs.

Postoperatively, oxygen was administered via Venti mask and monitoring of vitals was continued. In view of the only intraoperative episode of ventricular tachycardia and the risk of postoperative complications of thyroid surgery, the patient was transported to the intensive care unit. In the intensive care unit, oxygen inhalation at 5 L/min was provided through venti mask and monitoring of vitals was carried out. Arterial blood gas results were pH 7.30, PaCO<sub>2</sub> 40 mmHg, PaO<sub>2</sub> 70 mmHg, Bicarbonate 24.5 mmol/L, and SaO<sub>2</sub> 98%. After 24 hours of stay in the ICU, patient was maintaining stable vital signs with an O<sub>2</sub> saturation of 96% (room air) and that her chest and cardiac examination was normal, she was shifted to the parent surgical ward.

## DISCUSSION

Skin and subcutaneous tissue infiltration with adrenaline prior to incision is a common practice in an attempt to decrease the vascularity of the tissues, which improves the surgical field view and reduces the blood loss while operating on a vascular field like head and neck surgeries. The maximum recommended dose of adrenaline for infiltration is 5-10 µg/kg, which may get altered due to simultaneous administration of inhaled anaesthetic agents. It is noted that inhalational agents slow the automaticity of the sino-atrial node and myocardial conduction, resulting in atrial and ventricular arrhythmias, which are further potentiated by the use of exogenous adrenaline. Johnston *et al.* calculated the ED<sub>50</sub> of adrenaline that produces arrhythmia with halothane to be 2.1 µg/kg and with isoflurane to be 6.7 µg/kg. However, there are case reports suggesting the occurrence of severe hypertension, tachycardia, pulmonary oedema, life-threatening arrhythmias and cardiac arrest on infiltration of only 20-30 µg of adrenaline [3].

Adrenaline containing local anaesthetic has been criticized due to the risk of possible massive systemic absorption of the drug,

resulting in undesirable cardiovascular effects. This risk is more likely in patients with cardiovascular disease and hypertension; an increase in blood pressure (BP) has also been reported after the injection of anaesthetics even in normotensive patients. It is also widely claimed that the use of local anaesthetics with adrenaline predisposes to undesirable cardiovascular changes that may result in life-threatening medical complications, representing a risk to patients with heart disease, especially those previously undiagnosed [4].

In our case, the surgeon slowly infiltrated 20 micrograms of adrenaline (1:200,000) in 2% lignocaine solution around the tumour site after frequent aspirations. The dilution was well within the recommended dose. However, the onset of hypertensive crisis followed by sustained ventricular tachycardia was unexpected and dramatic. As head and neck tumors are usually highly vascular, a large surface area for rapid absorption of the drug cannot be excluded neither an accidental intravascular injection.

To prevent the adrenaline-induced cardiovascular crisis, a patient's family and personal history regarding cardiovascular diseases, cryptorrhea, and medication should be thoroughly investigated before the operation and attention should be paid to the ventilation, blood pressure, heart rate, and the heart rhythm during the operation. The treatment for adrenaline-induced cardiovascular crisis is symptomatic and similar to the therapy for pheochromocytoma. For the treatment of severe hypertension, a  $\alpha$ -blocker like phentolamine and short acting  $\beta$ - blockers like Esmolol for tachycardia are recommended. Calcium-channel blockers, such as verapamil and diltiazem, are also used for hypertension, tachycardia, and arrhythmia. The cardiopulmonary resuscitation algorithm is practiced for the treatment of arrhythmia and cardiac arrest. Amiodarone affects the sodium channel, potassium channel, and calcium channel, and it has a blocking effect on  $\alpha$  and  $\beta$  sympathetic nerve receptors. It is recommended as the drug of choice in pulseless ventricular tachycardia and ventricular fibrillation patients who are unresponsive to electrical cardioversion. The recommended initial intravenous injection of 150 mg for 10 minutes, and the daily maximum allowance is 2.2 g [5].

In conclusion, We managed to treat intraoperative adrenaline-induced cardiovascular crisis and terminate the fatal ventricular tachycardia by electrical cardio version in less than three minutes without sequelae and successfully completed the surgical procedure. We learned that the cardiovascular crisis and arrhythmia can take place even after the recommended dilute dose of adrenaline for infiltration in a healthy patient without any heart disease. Therefore, the operating surgeon and Anaesthesiologist shall exercise caution while infiltrating adrenaline in head and neck surgeries with careful monitoring.

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