

Atrial fibrillation under sub arachnoid block: Is Hydrogen peroxide irrigation the culprit?

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ABSTRACT

A 67 year old man posted for wound debridement of septic arthritis of the left hip developed atrial fibrillation after hydrogen peroxide irrigation during spinal anesthesia. Hydrogen peroxide is known to cause oxidative stress and air emboli leading to cardiac arrest. It has also been seen to affect action potential of cardiac myocytes in guinea pigs, but studies in humans are lacking. Exact cause of this event could not be elicited but hydrogen peroxide as a causative agent could not be ruled out either.

Key words: Atrial fibrillation, hydrogen peroxide, subarachnoid block

INTRODUCTION

Hydrogen peroxide has been used medically for almost a century as an agent for wound irrigation but despite its popularity, there are concerns with wound healing, cytotoxicity, and embolic phenomena^[1]. There have been case reports of cardiac arrest following hydrogen peroxide wash attributed to the air embolism that can occur after its use^[2]. Hydrogen peroxide has been shown to induce oxidative stress at the cellular level and even cause changes in the cardiac myocytes in the guinea pig heart^[3]. Studies regarding action potential changes in the human heart are lacking. We report a successful intraoperative management of atrial fibrillation after hydrogen peroxide irrigation in elderly patient of 67 years under subarachnoid block posted for septic arthritis hip.

CASE REPORT

This case is being reported after informed consent of the patient concerned. A 67 year old, 65 kg man was posted for wound debridement for septic arthritis of the left hip. The patient had undergone 17 previous surgeries for the same reason in the past 5 years, one being under general anaesthesia and 16 under subarachnoid block, all being uneventful but details were unavailable. The last wound debridement was done one and a half months back under subarachnoid block without any complications. Pre-

operatively there were no associated co-morbidities with a heart rate of 80/min, regular and normal rhythm and BP of 118/70 mmHg. Functional capacity could not be assessed as patient was bedridden for almost 2-3 months. There was no history of any previous cardiac complications, palpitations, syncope, myocardial infarction or stroke. The pre-operative ECG and blood investigations were within normal limits.

Patient was scheduled for elective surgery and was adequately fasted for 8 hours, as patient had already undergone multiple previous surgeries so no premedication was advised. Once inside the operation theatre, standard monitors including ECG, NIBP and pulse oximetry were attached and an 18 G intravenous (i.v) line was taken in the non-dominant hand and ringer lactate 10ml/kg was given over 20 min. under strict aseptic precaution, a 25 gauge Quincke-Babcock spinal needle was used to administer 3 ml of 0.5% bupivacaine and 25ug of fentanyl at L3-L4 subarachnoid space in sitting position. Once the level of

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sensory block was achieved to desired level of T10 after 5min, surgeon was advised to position the patient in right lateral and proceed with surgery.

One hour after the subarachnoid block, the surgeons used hydrogen peroxide to irrigate the wound. Suddenly the heart rate of the patient increased from 88/min to 210/min with BP of 100/78 mmHg and laboured respiration. Immediately the surgeon was informed and the procedure was paused and the patient's respiration was assisted with the help of face mask and Bain's circuit with 100% oxygen, simultaneously carotid sinus massage was also done. Blood pressure dropped further to 90/60 mmHg and was managed with bolus of 200 ml of Normal Saline (NS) and mephentermine 15mg i.v. The patient was asked for any palpitations or breathing difficulty for which he denied. In view of persisting tachycardia, cardiology consultation and 12-lead ECG was done. The rhythm on the monitor was identified as supraventricular tachycardia but 12 lead ECG was awaited for confirmation. Vagal manoeuvres were ineffective and hence, esmolol 30mg i.v. was given over 1 minute. After a brief drop in heart rate to 160/min it again rose to 190/min with Mean arterial pressures in range of 60-68 mmHg. The surgical site was closed and the patient was made to lie supine.

12-lead ECG was obtained by this time and the cardiology consultant identified the rhythm to be atrial fibrillation. Rate was controlled with diltiazem 20mg i.v. given over 2 minutes. With proper monitoring and resuscitation equipment the patient was transferred to the cardiology ICU. There was no deterioration in level of consciousness or any hypotension during transfer to cardiac ICU. At the time of transfer the heart rate was 120/min and blood pressure 110/70. The patient was prescribed metoprolol 25mg per oral in the evening rounds and was discharged from the ICU after 24 hours monitoring. At the time of discharge the pulse was 100/min and BP 120/78 mmHg. The ECG after a week of beta blocker therapy showed normal sinus rhythm

DISCUSSION

Deep surgical site infection remains a challenging and devastating problem in orthopaedic surgery. The implantation of hardware devices can result in difficult to treat infections, often necessitating reoperations and prolonged antibiotic therapy which place a significant strain on the patient, physician, and healthcare system. In

arthroplasty, the infection burden is continuing to rise with increasing bacterial resistance, surgical complexity and patient comorbidities. One method of surgically reducing the bacterial load is irrigation with antiseptic agent^[1].

Venous and arterial oxygen embolism during orthopaedic surgery following hydrogen peroxide irrigation has been reported before. One case report discussed cardiac arrest following the use of hydrogen peroxide during preparation of the femoral canal during hip arthroplasty. The most likely cause of the arrest was thought to be oxygen embolism. The authors suggested that the use of peroxide in an unvented femoral canal may be hazardous, as it has been shown to be in other closed cavities in the body^[4]. Another case scenario reported probable venous oxygen embolism resulting in cardiovascular collapse following irrigation of a necrotic breast wound with hydrogen peroxide^[5].

There have also been reports of significant cardiac dysrhythmia related to the use of this chemical agent during routine neurosurgical interventions. Causes were identified as intraoperative trigemino-cardiac reflex and mechanical stimulation of vital centre in anterior hypothalamus, brainstem, or either mechanical or thermal action of H₂O₂^[6]. Effects of hydrogen peroxide on action potentials and intracellular Ca²⁺ concentration were studied using guinea pig papillary muscles and ventricular myocytes. They suggested that the arrhythmia caused by Ca²⁺ overload was induced by H₂O₂, possibly by lipid peroxidation of cell membrane^[3]. There could be similar reasons for atrial fibrillation in this case but no studies exist to prove arrhythmias induced by hydrogen peroxide in humans.

The frequency of tachyarrhythmias during spinal anaesthesia is unknown. There has been one case report of self-terminating tachyarrhythmia after the uneventful initiation of spinal anaesthesia in which the patient had concealed Wolff-Parkinson White syndrome^[7]. Previous underlying unknown medical condition could be a reason for arrhythmias as well but in this case a complete cardiac evaluation post-operatively did not reveal any obvious anomalies. One of the highlights of this case was multiple episodes of regional anaesthesia in a non-ambulatory patient. Consequences of multiple spinal anaesthesia have not been studied nor are there any guidelines to describe intervals between successive attempts. We can only guess the cause of atrial fibrillation in this patient till further studies are done.

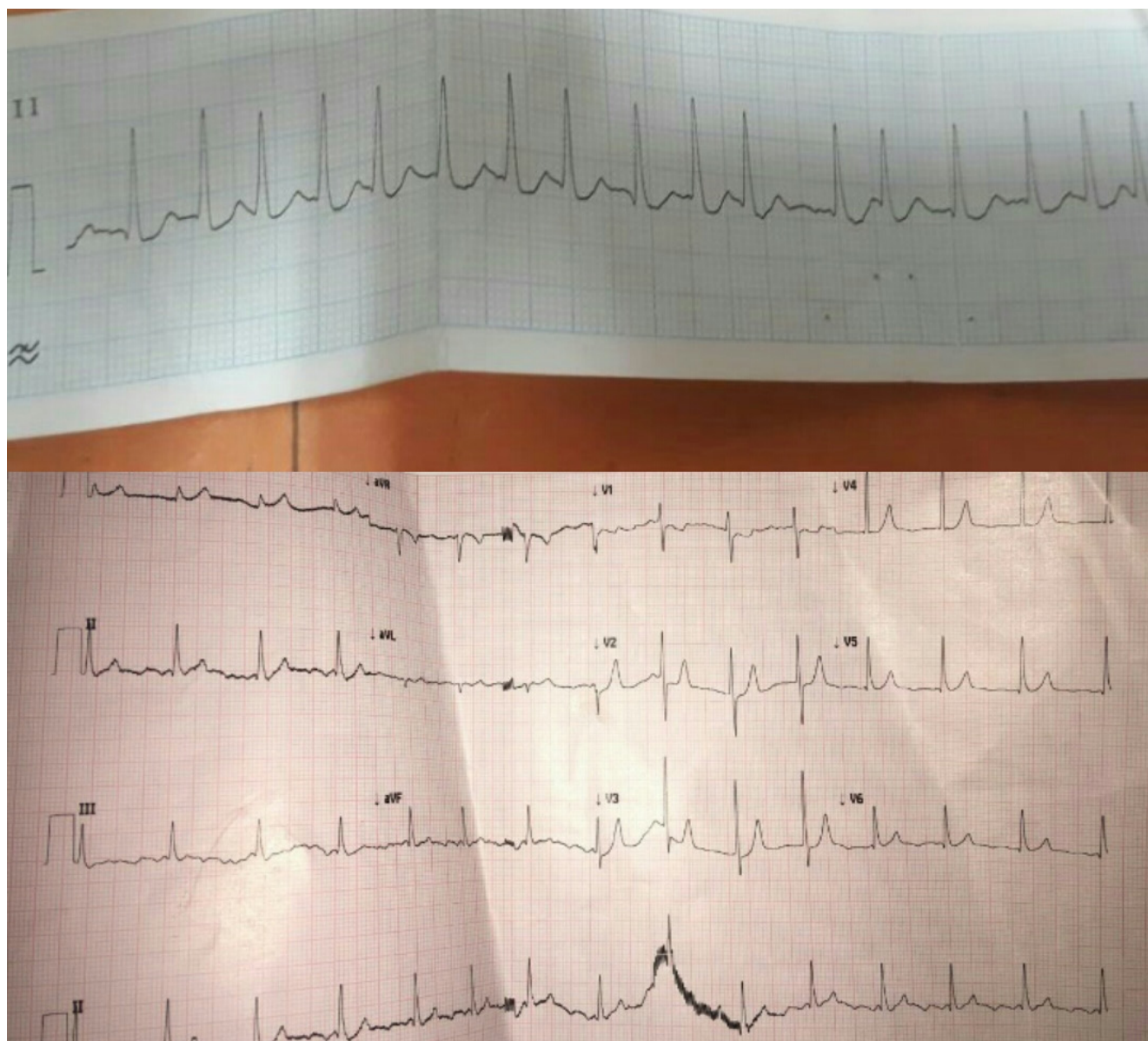


Figure 1. Above: The lead II ECG intra-operatively after hydrogen peroxide irrigation identified as atrial fibrillation. Below: the 12 lead ECG one week after the event, the patient being on metoprolol 25mg OD.

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