CASE REPORT OLGU SUNUMU

DOI: 10.5336/anesthe.2024-102609

Perioperative Atrial Fibrillation After Local Anesthetic Injection with Epinephrine

Epinefrinli Lokal Anestezik Enjeksiyonu Sonrası Gelişen Perioperatif Atriyal Fibrilasyon

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ABSTRACT This case study highlights the rare but significant risk of atrial fibrillation following local anesthesia with epinephrine, particularly in patients with cardiac disorders. We present a case of a 62-year-old female with a history of heart disease who developed atrial fibrillation during excision surgery for a right frontal lobe tumor. The surgery involved the use of a local anesthetic containing epinephrine on the scalp, a region with significant skin absorption. The study underscores the importance of heart rhythm monitoring and prompt management of cardiac irregularities during and after such procedures.

Keywords: Atrial fibrillation; epinephrine; local anesthesia; perioperative; arrhythmia; hemodynamic instability

Atrial fibrillation (AF) is the most common cardiac arrhythmia. It originates from irregular activities of atrial myocytes and can lead to numerous complications, including thromboembolic events, congestive heart failure, and even death.[1] Perioperative AF heightens the risk of in-hospital morbidity and mortality. Several studies have reported an increase in hospital stay and stroke risk, primarily focusing on perioperative AF following cardiothoracic surgery. However, evidence regarding perioperative AF and the effects of coexisting cardiovascular diseases and comorbidities following non-cardiothoracic surgery remains limited.[2-4] New-onset perioperative AF is not only associated with an increased risk of mortality post-surgery, but also correlates with a heightened risk of long-term stroke and mortality.[5]

CASE REPORT

A 62-year-old female patient was presented to our institution with a right frontal lobe tumor for excision surgery. The patient had a history of angioplasty with stent replacement seven years prior and was taking amlodipine, verapamil, aspirin, and clopidogrel medication. She was a non-smoker, had a body mass index (BMI) of 25, and her preoperative laboratory results were unremarkable. A cardiologist assessed the patient as New York Heart Association classifi-

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Peer review under responsibility of Turkiye Klinikleri Journal of Anesthesiology Reanimation.

Received: 05 Mar 2024 ***Received in revised form:*** 04 May 2024 ***Accepted:*** 06 May 2024 ***Available online:*** 07 May 2024

2146-894X

cation I. Her preoperative electrocardiogram (ECG) showed a normal sinus rhythm. An echocardiogram was not deemed necessary.

She was evaluated as ASA II for Physical Status Classification. Her blood pressure was 159/100 mmHg, heart rate 75 bpm, and SpO_2 level was 96%, as measured in the operation room. Anesthesia induction was performed with propofol, fentanyl, rocuronium bromide, and maintained with 2% sevoflurane and FiO_2 45%. The depth of anesthesia during skull clamp placement was monitored using the bispectral index, with a value of 50 indicating an adequate depth. The hypotensive agents used during the procedure included propofol, fentanyl, rocuronium bromide, and sevoflurane.

Under ultrasound guidance, central venous catheterization and invasive radial artery cannulation were performed. Post-anesthesia induction, the patient's blood pressure was 113/70 mmHg, heart rate 73 bpm. Lidocaine with epinephrine was subcutaneously injected along the incision line, and a skull clamp was applied at a bispectral index value of 50.

Five minutes later, the ECG monitor showed a high rate of 167 bpm and low blood pressure (35/25 mmHg). The ECG showed "absolutely" irregular RR intervals, indicating AF, sometimes known as absolute arrhythmia. There were no P waves, and some apparently regular atrial electrical activity could be seen in some ECG leads, most commonly in V1. The atrial cycle length (when visible) was often variable and <200 ms, indicating a heart rate of >300 bpm.

Metoprolol was injected at 1 mg intervals for a total dose of 3 mg. However, tachycardia persisted and blood pressure remained low; a bolus of 300 mg intravenous amiodarone was given in 100 mL of 5% dextrose. Subsequently, her cardiac rhythm and rate returned to normal sinus rhythm, and blood pressure recovered within 15 minutes.

During the 5-minute period when the patient's heart rate increased to 167 bpm and blood pressure decreased to 35/25 mmHg, no other interventions were performed. The patient's pressure was monitored continuously with an invasive artery, and the observed changes in heart rate and blood pressure were solely due to the administration of the local anesthetic and the physiological response to the skull clamp placement.

Post-operation, lab tests showed no electrolyte imbalance. The 3-hour surgery was complication-free, and the patient was extubated and moved to the intensive care unit (ICU). Post-op ECG monitoring was done. She was advised to see a cardiologist and resume isosorbide dinitrate and aspirin. After two days in the ICU, she was discharged to neurosurgery. Informed consent was obtained.

DISCUSSION

Catecholamines and cortisol levels can increase due to stress induced by any surgical procedure, resulting from tissue damage; this may lead to a sympathovagal and neuroendocrine imbalance. Blood loss, changes in body temperature, and fluids can lead to increased vascular resistance and hypotension, causing an imbalance between myocardial oxygen demand and delivery.[6]

Risk associated with the patient and the type of surgery or procedure are two main factors in identifying cardiovascular morbidity and mortality in patients undergoing non-cardiac surgery. Proper evaluation during the preoperative period and identifying the type and timing of the surgery may reduce the risk of complications.[7]

Increased sympathetic activity caused by stress from surgery and anesthesia predisposes the patient to arrhythmias. Clinical conditions including intraoperative hypotension, hypovolemia, anemia, trauma, and especially in our case, skull clamp insertion, may increase sympathetic activity.

The first step for an anesthesiologist in patients with perioperative AF is to check their oxygen and carbon dioxide status and identify the underlying cause of this arrhythmia. In our case, there were no issues with the ventilation and ventilator parameters, hence, hemodynamic data should be evaluated and the primary goal of treatment is to provide hemodynamic stability. In most cases, recognizing and eliminating the triggering cause will be immediately adequate.[8]

In most AF cases, beta-blockers or non-dihydropyridine calcium channel blockers (verapamil, dil-

tiazem) are beneficial medications to control heart rate. Patients with coronary artery disease and heart failure can use amiodarone as a first-line treatment. A meta-analysis showed an additional benefit in reducing AF with beta-blocker plus amiodarone compared with beta-blocker treatment alone.[10] In our case, the patient was stabilized with beta-blocker plus amiodarone. Metoprolol was used because esmolol was not immediately available in the operation room. As known, metoprolol is a more preferable option than diltiazem for maintaining heart rate control in critically ill patients with a rapid ventricular rate and may be a better perioperative option. In our case, the patient had both hypotension and tachycardia, so amiodarone was used to recover hemodynamic instability when beta-blockers were ineffective. It was observed that the treatment was effective because the patient's heart rhythm was normal sinus rhythm and normotensive on the monitor.

The onset of AF in our case could be related to the administration of epinephrine-containing local anesthetic solutions, which were used before skull clamp insertion. Despite the fact that local anesthetics are combined with epinephrine for local vasoconstriction, epinephrine alone increases sympathetic activity and hemodynamic disturbances, especially in elderly patients like ours. Although there are multiple patient-related factors that predispose to perioperative AF, increased age is the main factor, and the incidence of AF increases with age.[11]

The scalp's rich capillary perfusion can absorb high doses of local anesthetics, causing arrhythmias. Gitman et al. noted that local anesthetics can initially cause hypertension and tachycardia, progressing to bradycardia and hypotension. Adverse events usually occur within a minute of injection. Patients with cardiac diseases are at increased risk of local anesthetic systemic toxicity. Attentive dosing management is crucial, and less cardiotoxic agents like ropivacaine and levobupivacaine are recommended. In our case, lidocaine was used without exceeding the toxicity limit.

Upon reevaluation, a shorter-acting beta-blocker like esmolol could have been preferred. The quick positive response led to surgery continuation. Rhythm disturbance post-skull clamp insertion indicated sufficient anesthesia depth. The patient was extubated for a neurological check, then moved to the ICU. In conclusion, local anesthetics, especially with epinephrine, should be used cautiously in richly supplied tissues to prevent complications like in this case.

Source of Finance

During this study, no financial or spiritual support was received neither from any pharmaceutical company that has a direct connection with the research subject, nor from a company that provides or produces medical instruments and materials which may negatively affect the evaluation process of this study.

Conflict of Interest

No conflicts of interest between the authors and / or family members of the scientific and medical committee members or members of the potential conflicts of interest, counseling, expertise, working conditions, share holding and similar situations in any firm.

Authorship Contributions

Idea/Concept: *İremgül Nalbat, Yeşim Çokay Abut;* ***Design:*** *İremgül Nalbat;* ***Control/Supervision:*** *Yeşim Çokay Abut;* ***Data Collection and/or Processing:*** *İremgül Nalbat;* ***Analysis and/or Interpretation:*** *Yeşim Çokay Abut;* ***Literature Review:*** *İremgül Nalbat;* ***Writing the Article:*** *İremgül Nalbat;* ***Critical Review:*** *Yeşim Çokay Abut.*

REFERENCES

1. Liao HR, Poon KS, Chen KB. Atrial fibrillation: an anesthesiologist's perspective. Acta Anaesthesiol Taiwan. 2013;51(1):34-6. PMID: 23711604.
2. Subramani Y, El Tohamy O, Jalali D, Nagappa M, Yang H, Fayad A. Incidence, risk factors, and outcomes of perioperative atrial fibrillation following noncardiothoracic surgery: a systematic review and meta-regression analysis of observational studies. Anesthesiol Res Pract. 2021;2021:5527199. PMID: 34007270; PMCID: PMC8099514.
3. Villareal RP, Hariharan R, Liu BC, Kar B, Lee VV, Elayda M, et al. Postoperative atrial fibrillation and mortality after coronary artery bypass surgery. J Am Coll Cardiol. 2004;43(5):742-8. PMID: 14998610.
4. Sohn GH, Shin DH, Byun KM, Han HJ, Cho SJ, Song YB, et al. The incidence and predictors of postoperative atrial fibrillation after noncardiothoracic surgery. Korean Circ J. 2009;39(3):100-4. PMID: 19949595; PMCID: PMC2771806.
5. Lin MH, Kamel H, Singer DE, Wu YL, Lee M, Ovbiagele B. Perioperative/postoperative atrial fibrillation and risk of subsequent stroke and/or mortality. Stroke. 2019;50(6):1364-71. PMID: 31043148.
6. Halvorsen S, Mehilli J, Cassese S, Hall TS, Abdelhamid M, Barbato E, et al; ESC Scientific Document Group. 2022 ESC Guidelines on cardiovascular assessment and management of patients undergoing non-cardiac surgery. Eur Heart J. 2022;43(39):3826-924. Erratum in: Eur Heart J. 2023;44(42):4421. PMID: 36017553.
7. Halvorsen S, Mehilli J, Cassese S, Hall TS, Abdelhamid M, Barbato E, et al; ESC Scientific Document Group. 2022 ESC Guidelines on cardiovascular assessment and management of patients undergoing non-cardiac surgery. Eur Heart J. 2022;43(39):3826-924. Erratum in: Eur Heart J. 2023;44(42):4421. PMID: 36017553.
8. Ak Yılmaz H, Taşkın K, Erkalp K. Peri-postoperative atrial fibrillation in noncardiothoracic surgeries: approach of the anesthesiologist. Bagcilar Med Bull 2022;7(3):192-6. doi: 10.4274/BMB.galenos.2022.2022-07-065
9. Halvorsen S, Mehilli J, Cassese S, Hall TS, Abdelhamid M, Barbato E, et al; ESC Scientific Document Group. 2022 ESC Guidelines on cardiovascular assessment and management of patients undergoing non-cardiac surgery. Eur Heart J. 2022;43(39):3826-924. Erratum in: Eur Heart J. 2023;44(42):4421. PMID: 36017553.
10. Bagshaw SM, Galbraith PD, Mitchell LB, Sauve R, Exner DV, Ghali WA. Prophylactic amiodarone for prevention of atrial fibrillation after cardiac surgery: a meta-analysis. Ann Thorac Surg. 2006;82(5):1927-37. PMID: 17062287.
11. Karamchandani K, Khanna AK, Bose S, Fernando RJ, Walkey AJ. Atrial fibrillation: current evidence and management strategies during the perioperative period. Anesth Analg. 2020;130(1):2-13. PMID: 31569164.
12. El-Boghdadly K, Pawa A, Chin KJ. Local anesthetic systemic toxicity: current perspectives. Local Reg Anesth. 2018;11:35-44. PMID: 30122981; PMCID: PMC6087022.