

Table 2 Side effect of iron chelating agents and drugs used in the treatment of cortical venous thrombosis^{6,10}

Drug	Side effects
Decitabine	Neutropenia, thrombocytopenia, anemia, fatigue, pyrexia, nausea, cough, petechiae, constipation, diarrhea, and hyperglycemia
Hydroxycarbamide	Increased risk of infection, breathlessness, bruising, bleeding gums or nosebleeds, fever, fatigue
Desferrioxime	Ocular and retinal toxicity, growth impairment, ototoxicity, thrombocytopenia, abdominal pain, diarrhea, nausea, vomiting and hypotension, increased risk of infection

Conflict of Interest

None declared.

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Case Report



Left Frontal Lobe Tumor-Induced Intraoperative Premature Ventricular Beats

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In the absence of cardiac pathology, premature ventricular contractions (PVCs) in neurosurgical patients frequently accompany subarachnoid hemorrhage, intracerebral hemorrhage, traumatic brain injury, or raised intracranial pressure. PVCs detected during preanesthesia assessment prompts detailed cardiac evaluation. Our 57-year-old

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Keywords

- ▶ left frontal lobe tumor
- ▶ premature ventricular contractions
- ▶ lignocaine
- ▶ autonomic nervous system imbalance

patient, a case of left frontal meningioma, with controlled hypertension, diabetes and hypothyroidism, had normal preoperative ECG and potassium. However, immediately on anesthesia induction, she developed multiple refractory to treatment PVCs but with normal blood pressure. Anesthesia, which was maintained with sevoflurane and fentanyl, was deepened to exclude light anesthesia as the cause, without useful outcome. Two lignocaine boluses (100 mg each), followed by its infusion, also proved ineffective. Her blood gases and potassium, checked twice, were normal. Throughout, her hemodynamics remained stable. As soon as tumor was removed, the PVCs disappeared not to return. Her postoperative recovery was uneventful with normal ECG.

Introduction

ECG changes in a neurosurgical patient in the absence of acute coronary event are known to occur following aneurysmal subarachnoid hemorrhage (aSAH), intracerebral hemorrhagic stroke, and traumatic brain injury (TBI). Whereas ECG changes are transient and subside without any treatment in the aSAH, in TBI, these changes revert to normal following treatment of underlying pathology.¹ Another source of arrhythmias in neurosurgical patients is secondary to disruption of autonomic nervous system (ANS) activity from neoplasms involving vital brain areas.² Primary brain areas involved in autonomic control of the brain-heart association are medial prefrontal cortex (mPFC), insular cortex (IC), and cerebellum. The right IC regulates sympathetic tone and left IC regulates parasympathetic tone. The mPFC lies at the crux of cortical regulation of visceral functions.³ Thus, a frontal lobe (FL) lesion might disrupt ANS activity, thereby creating an imbalance between parasympathetic and sympathetic activity, leading to arrhythmias. None of the reports so far has described arrhythmias resulting from a FL lesion under anesthesia, which disappeared with the excision of lesion.

We present a case report of an otherwise healthy female with left FL meningioma who developed multiple, unifocal, treatment refractory, premature ventricular contractions (PVCs) intraoperatively, which subsided, coinciding with the tumor excision.

Case Report

A 59-year-old, 71 kg, American Society of Anesthesiologists (ASA) II female, diagnosed with left FL meningioma, was scheduled for craniotomy and tumor excision. She was a known case of hypertension, diabetes, and hypothyroidism on medications. After admission, she was started on dexamethasone. Her complete blood count, serum potassium (4.1 mEq/L) blood glucose, and ECG were normal. Her thyroid-stimulating hormone (TSH) level was a tad on the higher side of 6.098 mIU/L (normal 0.35–4.94) with 50 mcg/day levothyroxine since 1 year, and normal T3 and T4 levels. Patient had good effort tolerance. Anesthesia was induced with fentanyl (2 mcg/kg) and propofol (2.5 mg/kg), and trachea intubated following rocuronium (1 mg/kg). At this stage, she developed multiple, monophasic PVCs (≥ 10 per

min); however, her blood pressure (BP) was normal. Besides routine monitoring, invasive radial artery pressure was also instituted. Mechanical ventilation was adjusted to maintain end tidal carbon dioxide around 32 mm Hg. Anesthesia was maintained with 50% oxygen in air, sevoflurane, and infusions of fentanyl (1 mcg/kg/h) and rocuronium. PVCs remained unabated despite two boluses of 100 mg lignocaine each at 10 minutes apart. She received dexamethasone 8 mg at induction and 0.5 gm/kg mannitol during craniotomy. To exclude light plane of anesthesia as the cause of PVCs, additional fentanyl 50 mcg was given, and sevoflurane increased to 1 minimum alveolar concentration (MAC) from 0.8 MAC, but PVCs continued at the same frequency. Arterial blood gas analysis (ABG) revealed normal potassium (3.9 mEq/L) and PaCO₂ 36 mm Hg. Wary of their conversion to multifocal type, lignocaine infusion was started at a rate of 2 mg/min, and it was increased to 3 mg/min after 30 minutes, because of the persistence of PVCs. Lignocaine infusion was continued for 150 minutes without any benefit. Repeat ABG analysis showed normal gases and potassium. During the entire period, patient's BP remained stable. No sooner did the surgeon remove the tumor, the PVCs vanished, not to return again. Lignocaine infusion was discontinued, and the rest of the surgical period was uneventful. Fentanyl and rocuronium infusions were terminated at muscle closure. Rocuronium was antagonized with sugammadex, and trachea extubated when patient was awake, with satisfactory spontaneous respiration. Estimated blood loss during surgery was 850 mL and urine output was 1500 mL. She received 6.5 L crystalloids and half liter of colloid over a period of 5 hours. She was transferred to neurocritical care unit where she remained stable with no arrhythmias on monitor. Her postoperative ECG showed no abnormality, and her course in the hospital was uneventful.

Discussion

Various brain pathologies can lead to a range of transient and benign ECG changes which, in turn, can lead to myocardial injury and even death.⁴ Cardiac rhythm is modulated by ANS, which alters its function by the reflex activation of cardiac autonomic nerves in response to central autonomic commands, including those associated with stress.⁵ It has also

been established that frontal cortex and heart are reciprocally connected.⁵ There are wide array of cortical connections between frontal cortex and IC and between prefrontal cortex (PFC) and hypothalamus.⁶ PFC itself modulates ANS function during stressful circumstances.⁷ The mPFC also indirectly regulates the ANS through projections to preautonomic nuclei in brainstem, including the nucleus of the solitary tract.⁸ Effects of mPFC on heart regulation have recently become more recognized.⁹ Left IC, which controls parasympathetic activity, appears to be involved in heart rate regulation, and damage to it may encourage proarrhythmia state.¹⁰ Left insular stroke is associated with an increased risk of adverse cardiac outcome and decreased cardiac wall motion compared with stroke in other locations.¹¹

Furthermore, hypertensive neurosurgical patients are more prone to stress from balanced anesthesia technique compared with total intravenous technique, which can result in sympathetic activation and parasympathetic withdrawal.¹² This, too, contributes to the aforementioned factors to engender a situation favorable for arrhythmias. Besides, another reason for reduction in parasympathetic tone (thus relative increase in sympathetic tone) in a hypertensive patient with left FL tumor might result from compression of cortical tracts between left IC and PFC, which is caused by the tumor, either due to surgical stress or from some hitherto unknown mechanism. Tilting of autonomic balance toward a relatively higher sympathetic tone generates arrhythmias, especially in a susceptible patient who might have underlying subclinical cardiac issues from long-standing hypertension.

Usual causes of intraoperative arrhythmias which include potassium imbalance, lighter planes of anesthesia, hypoxia, and hypercarbia were not present in our patient. Moreover, sevoflurane is also not arrhythmogenic.¹³ There were no signs and symptoms (headache/vomiting or bradycardia at presentation to operation room) suggestive of elevated intracranial pressure; importantly, the patient was on regular dexamethasone, and she also received mannitol intraoperatively. Untreated gross hypothyroidism (TSH levels greater than 10 mIU/L) is another known factor to predispose a patient to increased incidence of ventricular arrhythmias from increased Q-T dispersion¹⁴ It was reported by Kweon and colleagues that thyroxine replacement in hypothyroid patients significantly decreased QT dispersion, thereby reducing the incidents of ventricular arrhythmias¹⁵. Our patient was on thyroxine replacement therapy and her TSH was almost normal, and we assume this precluded hypothyroidism as a possible cause for her PVCs

We hypothesize that our patient (who was hypertensive) probably had underlying subclinical coronary issue, and the condition was aggravated by pressure of tumor from stress of volatile anesthesia or some unknown mechanism, on parasympathetic projections between left IC and mPFC, or its connections with hypothalamus. This diminished the parasympathetic tone and amplified the sympathetic tone relatively, thus producing PVCs. Tumour excision restored the

parasympathetic and sympathetic balance, and this resulted in cessation of PVCs.

In conclusion, in absence of obvious coronary disease, intraoperative PVCs in a hypertensive patient with left FL tumor are benign in nature, which disappear concurrent with excision of the tumor and do not need any pharmacological intervention.

Conflict of Interest

None declared.

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