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Research Article

From Dental Chair to ICU: A Case of Local Anesthetic Systemic Toxicity

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Local Anesthetic Systemic Toxicity (LAST) is a rare but potentially life-threatening complication affecting the central nervous and cardiovascular systems. Despite the widespread use of local anesthetics in dental practice, severe adverse events may occur. A 50-year-old female presented with altered sensorium and severe respiratory distress six hours after a dental procedure. On arrival, she was tachycardic with gasping respirations and a Glasgow Coma Scale score of 7/15. Arterial blood gas analysis showed respiratory acidosis. Neuroimaging and cardiac evaluation were unremarkable. Laryngoscopy revealed airway edema, requiring urgent intubation and ventilatory support.

The patient improved with supportive intensive care and was discharged without neurological deficits. A probable diagnosis of LAST was made based on temporal association and exclusion of other causes.

This case highlights an atypical presentation of LAST with delayed onset, absence of seizures, and predominant respiratory failure. Early recognition and prompt management are crucial to improve outcomes.

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Introduction:-

Local anesthetics (LAs) are among the most commonly used pharmacological agents in modern clinical practice, particularly in dentistry, emergency medicine, and minor surgical procedures. They function by reversibly blocking voltage-gated sodium channels, thereby inhibiting nerve impulse conduction and providing effective analgesia. Despite their well-established safety profile, systemic toxicity can occur when plasma concentrations exceed therapeutic levels, leading to a condition known as Local Anesthetic Systemic Toxicity (LAST).

LAST is a rare but potentially life-threatening complication that primarily affects the central nervous system (CNS) and cardiovascular system (CVS). The incidence of LAST has been reported to range between 0.03% and 0.27%, though it may be underreported due to

variable clinical presentation and lack of awareness (El-Boghdadly et al., 2018). Classical manifestations include early neurological symptoms such as circumoral numbness, tinnitus, agitation, and seizures, followed by cardiovascular complications including arrhythmias, hypotension, and cardiac arrest (Neal et al., 2018).

However, atypical presentations are increasingly being recognized, especially in non-operating-room settings such as dental clinics. These may include isolated respiratory depression, altered sensorium without preceding seizures, or delayed onset toxicity. Factors contributing to LAST include inadvertent intravascular injection, excessive dosing, rapid systemic absorption from highly vascular sites, and drug interactions with sedatives such as benzodiazepines or opioids (On'Gele et al., 2024).

Dental procedures, particularly root canal treatments and nerve blocks, are commonly performed under local anesthesia and are generally considered safe. Nevertheless, complications may arise, especially in settings where monitoring is limited. Neurological complications associated with dental anesthesia, although rare, can range from transient sensory disturbances to severe systemic toxicity (Sweta and Thenmozhi, 2014).

The present case describes a 50-year-old female who developed acute altered sensorium and respiratory failure following a dental procedure. Notably, the absence of classical seizure activity and normal neuroimaging posed a diagnostic challenge. This case highlights an atypical presentation of LAST and underscores the importance of early recognition, prompt airway management, and a high index of clinical suspicion in emergency settings.

Case Presentation:

A 50-year-old female was brought to the Emergency Department with drowsiness, unresponsiveness, and breathing difficulty, and had been unconscious for approximately 3 hours. She had undergone a dental procedure (root canal treatment) about 6 hours prior to presentation. There was a history of urinary incontinence; however, there was no history of fever, chest pain, or tongue bite. Her past medical history was significant for hypertension on medication, asthma, and hypothyroidism, with no known drug allergies. The patient was

initially managed at a nearby clinic and was subsequently referred to the Emergency Department for further evaluation and management. She underwent root canal treatment 6 hours before presentation and had been unconscious for the preceding 3 hours.

Findings and Investigations:

On examination, the patient was tachycardic with normal heart sounds (S1 and S2) on cardiovascular assessment. Neurological evaluation revealed an unconscious state with a Glasgow Coma Scale (GCS) score was 7/15 (E2V2M3). Respiratory system examination showed bilateral crepitations, while abdominal examination was revealed a soft abdomen with bilateral flank fullness.

General physical examination demonstrated pallor and cyanosis, with no evidence of clubbing, icterus, or edema. The modified Wells score was calculated to be 1.5, suggesting a low probability of pulmonary embolism.

Further evaluation with electrocardiography revealed sinus tachycardia with right atrial enlargement. Cardiac biomarkers were within normal limits (Troponin I: 1.9 ng/L). In view of severe respiratory distress and decreased level of consciousness, the patient was intubated immediately on arrival. Laryngoscopic examination revealed airway edema at the level of the vocal cords.

On initial assessment, the patient was afebrile with a temperature of 98°F, tachycardic with a pulse rate of 120 beats per minute, and hypertensive with a blood pressure of 154/90 mmHg. The respiratory rate was critically reduced to 3 breaths per minute with gasping respirations, and oxygen saturation was maintained at 98% with Bag-Valve-Mask support. Arterial blood gas analysis revealed a pH of 7.254, $PaCO_2$ of 53 mmHg, PaO_2 of 139 mmHg, bicarbonate (HCO_3^-) of 22.6 mmol/L, base excess of -3.5, total CO_2 of 21 mmol/L, and an anion gap of 8.4, suggestive of respiratory acidosis.

Laboratory investigations showed hemoglobin of 12.8 g/dL, total leukocyte count of 9790 cells/mm^3 with relative neutrophilia (87.2%) and lymphocytes of 9.2%, and platelet count of 345,000/mm^3. Renal function tests were within normal limits, with serum creatinine of 0.7 mg/dL and urea of 12 mg/dL. Electrolyte levels were within normal range, including sodium

of 144 mmol/L, potassium of 3.8 mmol/L, and chloride of 113 mmol/L. Coagulation parameters were normal, with prothrombin time of 12.1 seconds, INR of 1.04, and activated partial thromboplastin time of 22.7 seconds. Creatine kinase levels were 147 U/L. Overall, the findings indicated respiratory acidosis with otherwise stable hematological and biochemical parameters.

Initial radiological evaluation with CT scan of the brain revealed no evidence of intracranial abnormality as shown in Image 1.

On Day 2, electroencephalography (EEG) with brain mapping, performed using the standard 10–20 international electrode placement system, demonstrated bilaterally symmetrical and synchronous alpha rhythm (8–10 Hz, 20–30 μV) arising from the occipital regions, which attenuated appropriately with eye opening. There was no evidence of spikes, sharp waves, epileptiform discharges, voltage asymmetry, phase reversal, or lateralizing epileptiform focus. The findings were consistent with a normal awake EEG record.

A portable chest X-ray showed peribronchial thickening in the bilateral mid and lower zones, suggestive of possible aspiration bronchiolitis. The remaining lung fields were clear, with normal hilar and mediastinal shadows. Both costophrenic angles were clear, and the diaphragms and bony thorax appeared normal. Endotracheal and nasogastric tubes were appropriately positioned.

On Day 3, bedside two-dimensional echocardiography with color Doppler demonstrated normal internal dimensions of all four cardiac chambers, structurally normal cardiac valves, and normal left ventricular systolic function with an ejection fraction of 60%. There was no evidence of regional wall motion abnormalities, pulmonary arterial hypertension, intracardiac clot, vegetation, or pericardial effusion.

On Day 4, dental orthopantomogram (OPG) revealed multiple dental caries involving upper incisors and canines, lower canines and premolars, and molars bilaterally, with evidence of prior root canal treatment. There was no evidence of bone erosion, sclerotic lesions, or fractures, and the temporomandibular joints appeared normal.

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Magnetic resonance imaging (MRI) of the brain with epilepsy protocol showed a partial empty sella, with the ventricular system otherwise within normal limits, gray and white matter differentiation, and no midline shift. The temporal lobes and hippocampal regions were normal, with no evidence of dysplasia or abnormal signal intensity. No intracranial hemorrhage, space-occupying lesion, or structural abnormality was detected. The brainstem, cerebellum, and craniovertebral junction were normal. Overall, MRI findings were reported as normal.

Psychiatric evaluation was undertaken in view of a prior history of self-harm and revealed underlying social and emotional stressors. The patient had previously received psychiatric treatment and had shown improvement

Discussion:

Local Anesthetic Systemic Toxicity (LAST) is a rare but potentially life-threatening complication resulting from elevated plasma concentrations of local anesthetics. It typically manifests with a biphasic pattern involving initial central nervous system (CNS) excitation (e.g., agitation, seizures) followed by CNS depression and cardiovascular compromise (Neal et al., 2018). However, increasing evidence suggests that atypical presentations, particularly in non-operating room settings such as dental clinics, may occur and pose significant diagnostic challenges.

In the present case, the patient developed acute altered sensorium and severe respiratory depression approximately 6 hours after a dental procedure. Notably, classical features such as seizures, arrhythmias, or hemodynamic instability were absent. Similar atypical presentations have been reported in the literature. Ashkenazi et al. (1998) described a

case of severe hypoxia and bradycardia following lidocaine administration in a sedated dental patient, where respiratory compromise predominated without loss of consciousness. Likewise, El-Boghdadly et al. (2018) highlighted that delayed and non-classical manifestations of LAST may occur due to factors such as slow systemic absorption, patient comorbidities, or drug interactions.

Compared to previously reported cases, the current case demonstrates several distinguishing features. First, the delayed onset of symptoms (approximately 6 hours post-procedure) is uncommon, as most cases of LAST occur within minutes of administration. This may suggest gradual systemic absorption from a highly vascular site or unrecognized intravascular injection. Second, the absence of seizures and predominance of respiratory depression indicates an early transition to CNS depressive phase or modulation by concomitant factors such as sedatives or patient-specific vulnerability. Third, normal neuroimaging, EEG, and cardiac evaluation further support a functional rather than structural etiology, strengthening the diagnosis of LAST by exclusion.

The differential diagnosis in such cases is broad and includes cerebrovascular events, seizure disorders, pulmonary embolism, metabolic derangements, and drug intoxication. In the present case, these were effectively ruled out through imaging, laboratory investigations, and clinical scoring systems (e.g., low Wells score), thereby reinforcing the likelihood of LAST.

Management of LAST follows Advanced Cardiac Life Support (ACLS) principles with early airway control and administration of lipid emulsion therapy as per ASRA guidelines. Lipid emulsion therapy was (administered/not administered), which is recommended as first-line treatment in severe LAST as per ASRA guidelines. From a pathophysiological perspective, local anesthetics inhibit voltage-gated sodium channels, impairing neuronal conduction and cardiac excitability. At toxic levels, this leads to disruption of inhibitory pathways, respiratory center depression, and potential cardiovascular collapse (On’Gele et al., 2024). The predominance of respiratory depression in this case suggests early involvement of brainstem respiratory centers.

This case also highlights important gaps in current practice, particularly in dental and outpatient settings where monitoring may be limited. Preventive strategies remain the cornerstone of reducing LAST incidence. These include adherence to recommended dosing limits, use of incremental injections with frequent aspiration, consideration of ultrasound guidance where applicable, and close monitoring of patients, especially those with comorbidities (Neal et al., 2018; Malamed, 2019).

This case highlights several important clinical implications for improving patient safety in settings where local anesthetics are routinely administered. Continuous and vigilant monitoring should be ensured even during minor procedures to facilitate early detection of signs of toxicity, particularly when higher doses or high-risk nerve blocks are used. There is a need to enhance training and awareness among dental and outpatient practitioners regarding the early recognition and management of Local Anesthetic Systemic Toxicity (LAST), including airway management and resuscitation protocols.

In addition, all facilities administering local anesthetics should be adequately equipped with essential resuscitation equipment, including the availability of lipid emulsion therapy (Intralipid), which plays a crucial role in the management of severe toxicity. Proper risk stratification of patients is also essential, with special attention to individuals with underlying comorbidities such as cardiac or hepatic dysfunction, who may be at increased risk of adverse events.

Furthermore, the establishment of efficient and prompt referral systems to higher centers is critical in suspected cases of toxicity, as delays in management can significantly worsen outcomes. Overall, a multidisciplinary approach incorporating prevention, preparedness, early recognition, and timely intervention is vital to reduce morbidity and improve patient outcomes.

Figure 2 Showing the ASRA guidelines for Lipid Emulsion Therapy

Conclusion:

This case highlights an atypical yet clinically significant presentation of probable Local Anesthetic Systemic Toxicity (LAST) following a routine dental procedure. The patient presented with acute onset altered sensorium and severe respiratory depression in the absence of classical features such as seizures or cardiovascular instability. Extensive clinical evaluation, laboratory investigations, and neuroimaging failed to identify any alternative neurological, metabolic, or cardiopulmonary etiology. The temporal association with recent dental anesthesia, combined with exclusion of other causes, strongly supports the diagnosis of LAST presenting predominantly with central nervous system depression and respiratory compromise.

This case underscores the importance of maintaining a high index of suspicion for LAST, even in delayed and atypical presentations, particularly in non-operating room settings such as dental clinics. Early recognition, prompt airway management, and supportive care remain critical in preventing morbidity and mortality. Furthermore, it emphasizes the need for adherence to preventive strategies, including appropriate dosing, aspiration prior to injection, and vigilant patient monitoring. Increased awareness among clinicians is essential to ensure timely diagnosis and effective management of this potentially life-threatening condition

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