

# Management of Local Anesthetics Systemic Toxicity in a 66-Year-Old Male Undergoing Nephrostomy Percutaneous

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## ABSTRACT

**Background:** Neuraxial anesthesia compares favourably with other systemic and regional methods about safety and efficacy. The complications related to neuraxial anaesthesia including transient neurological symptoms, inadvertent intrathecal injection and cardiac arrest. Local anesthetics systemic toxicity (LAST) is one of a life-threatening complication when the effects of local anesthetics reach the systemic circulation.

**Case:** We report a local systemic toxicity on 66-year-old male who underwent bilateral nephrostomy percutaneous. Patient were hemodynamically stable and were placed in supine position, preoperatively. Head-to-toe examination showed an increased bronchial breath sounds and rough crackles in the 4-5 left and right intercostal space. Laboratory examinations revealed anemia (Hb 10.6 g/dl) and impairment on kidney function (ureum 148 mg/dl; creatinine 4.9 mg/dl). Patient were planned to do an epidural at the level of L2 - L3 with a 14 ml levobupivacaine 0.5% in incremental doses 5 mg - 5 mg - 4 mg. Shortly after receiving the third incremental doses of levobupivacaine the patient experienced in disruption on cardiovascular and neurovascular system which showed as persistent bradycardia and loss of consciousness. Patient decided to undergo general anesthesia with lipid emulsion infusion and showed an improvement afterwards.

**Conclusion:** The main principle of LAST management is to ensure adequate ventilation and organ perfusion with sufficient oxygen-rich-blood to perfuse on brain, heart, and kidneys to prevent acidosis until lipid emulsion therapy. LAST management requires prompt and precise diagnosis and treatment to get a good outcome.

Keywords: LAST, lipid emulsion, nephrostomy, Epidural

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Received: October 2021, Revised: September 2022, Published: September 2022

How to cite this article: Nugroho A, RR Oktavianto. Management of local anesthetics systemic toxicity in a 66-year-old male undergoing nephrostomy percutaneous. *Journal of Anaesthesia and Pain*. 2022;3(3): 61-64. doi: 10.21776/ub.jap.2022.003.03.06

## INTRODUCTION

Local anesthetics have been widely used in many clinical practices over the past 50 years, from emergency departments to operating theatres.<sup>1</sup> Application of local anesthetics (LA) is diverse and considered safe and effective when risk factors such as injection site, infiltration tissue, nerve, or plexus block are controlled.<sup>2</sup> However, Local Anesthetics Systemic Toxicity (LAST) was a life-threatening and rare complication of local anesthetics procedure. The incidence is estimated to be 0.03% or 0.27 episodes per 1,000 peripheral nerve blocks.<sup>3</sup> The risk of LAST may be increased by the presence of a patient's cardiovascular disorder, age, renal impairment, or type of drug used.<sup>4</sup> Manifestations of LAST can vary depending on the type of anesthetic used.<sup>5</sup> We present a rare and severe case of LAST in a 66-year-old male who underwent bilateral nephrostomy percutaneous with neuraxial anesthesia and its management in our tertiary hospital with a multidisciplinary approach.

## CASE

A 66-year-old male routinely controlled at the Surgery Department of Dr. Moewardi General Hospital. The patient was diagnosed with hydronephrosis, and the primary plan is to have a bilateral nephrostomy with the secondary plan is urethral stenting if failed. The patient has a history of transurethral resection of the prostate (TURP) and Transurethral resection of bladder tumor (TURB) due to carcinoma bladder and prostate one year ago. The patient has a chronic hypertension and non-adherent to medication for 3 years and has undergone hemodialysis. The patient denied any history of allergies, alcohol consumption, or other drugs.

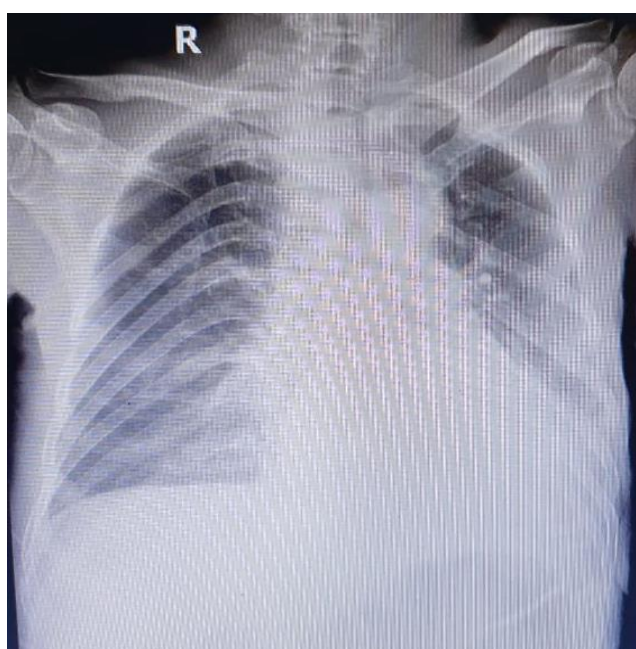
The patient was compos mentis Glasgow coma scale (GCS) 15 and hemodynamically stable (blood pressure 149/94 mmHg, pulse rate 120 bpm, respiratory rate 22 bpm, oxygen saturation on 87-88% with room air supine position and 97% with

non-breathing mask (NRM) 8 lpm. Head-to-toe examination revealed increased bronchial breath sound and coarse crackles in the 4-5 intercostal spaces bilaterally. Patients' clinical presentation showed in figure 1.

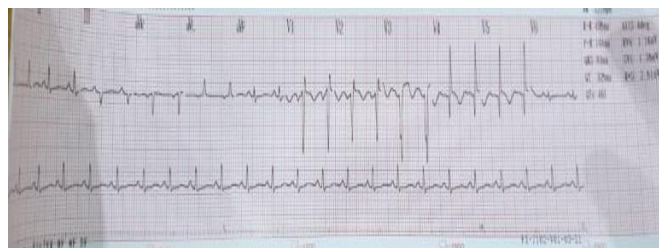
Work-up examinations such as laboratory findings, radiological examination, and electrocardiogram were planned. Complete blood count found anemia (hemoglobin 10.6 g/dl) and impairment in kidney function (urea 148 mg/dl, creatinine 4.9 mg/dl). Other markers within normal limits (hematocrit 30%, leukocytes 17.100/mm<sup>3</sup>). Radiological examination showed pneumonic-type pulmonary metastases and cardiomegaly with aortosclerosis (Figure 2). Electrocardiography showed sinus rhythm tachycardia, 115 beats per minute, normoaxis with a T inverted in lead V1 to V5 (Figure 3).



**Figure 1.** Patient clinical presentation



**Figure 2.** Radiological examination showed sinus rhythm tachycardia



**Figure 3.** Preoperative electrocardiography

The patient was informed about the surgery, and medical approval was obtained. The patient was taken to the operating room, and a monitor was installed according to the ASA recommendations. The patient's blood pressure was 141/68 mmHg, pulse rate was 118 bpm, and respiratory rate 28 bpm with oxygen saturation 98% with NRM 10 lpm. The fluid loss was maintained with minimal NaCl crystalloid solution and allowable blood loss was measured at 675 cm<sup>3</sup>. The patient was placed in a sitting position for the epidural procedure with the puncture at the level of L2-L3, and the administered local anesthesia was given with 2% lidocaine. The Tuohy needle was inserted up to the ligamentum flavum, followed by air loss of resistance (LOR), and epidural catheter with tip L1-L2 and continued with fixation of the catheter and given a test dose (pehacaine 1.2 ml and lidocaine 2% 1.05ml diluted with NaCl to 3 ml). The patient was then placed into a supine position. The test dose resulted in an increased heart rate of <20% then 14 ml levobupivacaine 0.5% agent was given with incremental doses of 5 ml - 5 ml - 4 ml every 5 minutes.

Shortly after receiving the third incremental dose of levobupivacaine, the patient experienced in disruption in on the cardiovascular and neurovascular system which showed persistent bradycardia (72/46 mmHg, the pulse rate was 58 bpm) and loss of consciousness (decreased GCS with eye score 1, verbal scored 1 and movement scored 2). Oxygenation with 100% oxygen via a face mask was immediately given. Intubation was performed to secure the airway with premedication of fentanyl 2 µg/kg and Atracurium 0.5 mg/kg. An Endotracheal tube size 7.5 was placed with a depth of 21 cm. Auscultation was performed to ensure breath sounds were heard in both lung fields. The patient was treated with LAST's management algorithm using lipid emulsion 20% 1.5 ml/kg rapid bolus followed by 0.25 ml/kg/min until hemodynamically stable. The patient was hemodynamically unstable during the operation which lasted for 60 minutes. Systolic blood pressure ranged from 75-90 mmHg, diastolic blood pressure between 45-65 mmHg, pulse rate between 58-68 bpm with SpO<sub>2</sub> 97-98% on controlled respiration and administration of dopamine 10mcg/kg/min syringe pump. Surgery was completed within 2 hours. The patient was shifted to the Intensive care unit (ICU) for close monitoring as the patient was drowsy. The analysis of serum electrolytes, blood sugar, and arterial blood gas was done immediately. No abnormality was detected in these investigations. After 2 h of close observation, the patient became conscious and oriented. His vitals were normal.

The patient was monitored for 12 hours post-emulsion administration and extubated in the ICU 1 day postoperatively then transferred to the inpatient room. Postoperative management with fentanyl analgesia 0.5 µg /kgBW/hour. No further episodes of impairment in the central nervous system or cardiovascular system (CNS or CVS) manifestation were seen. The patient recovered fully within 4 postoperative days and his postoperative period was uneventful, and he was discharged afterward

## DISCUSSION

Neuraxial anesthesia has been shown to be safe when performed properly, however, there is a risk of complications. Hypotension is an inevitable complication of spinal anesthesia that occurs when the sympathetic chain becomes blocked, especially when higher dermatome levels are needed. A decrease in body temperature is commonly encountered after neuraxial anesthesia. Radicular symptoms (pain, burning sensation, dysaesthesia, and paraesthesia) may be observed following spinal anesthesia.<sup>7</sup>

The choice of regional anesthetic is based on the onset, duration, and blockade of sensory-motor fibers, and the potential for systemic toxicity.<sup>7</sup> Levobupivacaine is a mixed racemic isomer of bupivacaine with a more arrhythmogenic, depressant effect, cardiac, and lower central nervous depression.<sup>8</sup>

Local anesthetics (LA) toxicity can occur when large amounts of LA enter the systemic circulation, suprathreshold blood, and tissues.<sup>9</sup> LAST usually begins with prodromal symptoms and signs such as perioral numbness, tinnitus, agitation, and dysarthria. Higher concentrations of LA affect all neurons, leading to the global central nervous system (CNS) depression, clinically seen as coma. Cardiovascular toxicity includes myocardial depression, conduction block, and decreased autonomic flow.

Management of LAST consists of 3 pillars namely seizure management, Advanced cardiac life support (ACLS), and administration of 20% lipid emulsion.<sup>10</sup> Supplementation of oxygen should be given, but invasive breathing should be considered in patients with unstable hemodynamics such as arrhythmia, apnea, or cardiac arrest.<sup>9,11</sup>

There were several potential contributors of LAST seen, and they can be categorized into those related to the injected drug, the patient, or the technique.<sup>13</sup>

LAs have differing intrinsic vasoactive effects. Levobupivacaine has dose-dependent vasoactive properties that may prolong the duration and slow systemic absorption as opposed to bupivacaine which has vasodilatory properties and may lead to more rapid systemic absorption.<sup>14</sup> In this case, we use a 14 ml levobupivacaine 0.5% agent with incremental doses of 5 ml - 5 ml - 4 ml every 5 minutes.

Patients at the extremes of age have consistently been shown to be at the most significant risk of LAST. Elderly patients have reduced clearance of LA due to reduced metabolic organ perfusion and pharmacodynamic function, thereby increasing the potential of drug accumulation with repeated boluses of LA or continuous infusions.<sup>15</sup> As the skeletal muscle may act as a reservoir for LA, reduced skeletal muscle mass has also been implicated in increasing the risk of LAST.<sup>13</sup> Our patient is categorized as geriatric (66-year-old) which is considered one of the risk factors of LAST.

Patients with severe renal disease developed hyperdynamic circulation and reduced clearance of LAs. As a result, free plasma concentrations are largely unchanged, and dose reduction is often unnecessary unless the patient is uremic with metabolic acidosis.<sup>13</sup> This patient suffers renal function

preoperatively with increased ureum and creatinine levels (urea 148 mg/dl, creatinine 4.9 mg/dl).

Patients with cardiac disease are at an increased risk of LAST. Those with pre-existing conduction disorders may be predisposed to cardiovascular toxicity, careful dosing, and the use of less cardiotoxic drugs.<sup>13</sup> Patients with severe, cardiac dysfunction are particularly susceptible to LA-induced myocardial depression and arrhythmias due to reduced hepatic and renal perfusion leading to reduced metabolism and elimination, respectively.<sup>15</sup> In our case, the patient revealed a history of STEMI which is documented as inverted T in lead V1 to V5, and a history of chronic hypertension and non-adherent to medication. Intraoperative the patient showed one of CVS manifestations as persistent bradycardia (Systolic blood pressure ranged from 75-90 mmHg, diastolic blood pressure between 45-65 mmHg, pulse rate between 58-68 bpm) which lasted for 60 minutes.

The main principle of LAST management is to ensure adequate ventilation and adequate organ perfusion with oxygen-rich blood to reach the brain, heart, and kidneys to prevent acidosis until lipid emulsion therapy.<sup>13</sup> After hemodynamic stability, lipid emulsion infusion was continued for 10 minutes, and the patient was evaluated for up to 12 hours post-administration.<sup>2</sup> Lipid emulsion has a scavenging effect that can extract LA from plasma.<sup>9,11,12</sup> Early administration of 20% intravenous lipid emulsion should be an immediate priority after airway management in any LAST event. An initial bolus of 100 mL should be administered over 2-3 minutes (1.5 mL/kg if the lean body weight is <70 kg). If circulatory stability is not attained, rebolusing up to two further times or increasing the infusion to 0.5 ml/kg/min is suggested. The maximum recommended 20% lipid emulsion dose is 12 ml/kg.<sup>13</sup> This case uses lipid emulsion 20% 1.5 ml/kg rapid bolus followed by 0.25 ml/kg/min until hemodynamically stable.

Following an episode of LAST with CVS features, patients should be monitored for at least 6 hours, while isolated and rapidly terminating CNS features require patient monitoring for a minimum of 2 hours.<sup>13</sup> Patient was monitored for 12 hours post-emulsion administration and extubated in the ICU 1 day postoperatively then transferred to the inpatient room. No further episodes of impairment CNS or CVS manifestation were seen.

## CONCLUSION

LAST management requires prompt and appropriate diagnosis and treatment to get a good outcome. We present a 66-year-old male who underwent a nephrostomy percutaneous complicated with LAST. We highlight the risk factor in our patient including anesthetic drugs, geriatric, renal and cardiovascular impairment, and the technique of LA's administration with incremental doses. Although we minimized the risk using less cardiotoxic drugs (levobupivacaine) and had undergone the test dose, however, our patient suffered with LAST intraoperatively. We successfully managed by securing the airway with controlled respiration and lipid emulsion 20% 1.5 ml/kg rapid bolus followed by 0.25 ml/kg/min until hemodynamically stable.

## ACKNOWLEDGMENT

None

## CONFLICT OF INTEREST

The author declares there is no conflict of interest.

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