

# Recurrent Ventricular Fibrillation After Hip Revision Surgery With Ropivacaine and Liposomal Bupivacaine Exposure: A Case Report

Hebin Qi

Guangzhou Red Cross Hospital

Jinyong Ke

Guangzhou Red Cross Hospital

Weilong Peng

Guangzhou Red Cross Hospital

Aiqun Wang

wangaiqun@ext.jnu.edu.cn

Guangzhou Red Cross Hospital

---

## Case Report

**Keywords:** Ropivacaine, Liposomal bupivacaine, Local anesthetic systemic toxicity, Ventricular fibrillation, Case report

**Posted Date:** October 5th, 2026

**DOI:** <https://doi.org/10.21203/rs.3.rs-10803872/v1>

**License:**   This work is licensed under a Creative Commons Attribution 4.0 International License.

[Read Full License](#)

**Additional Declarations:** No competing interests reported.

---

# Abstract

## Background

Local anesthetic systemic toxicity (LAST) is an uncommon but potentially fatal complication of regional anesthesia, peripheral nerve block, and local anesthetic infiltration. Delayed presentations may occur after fascial plane blocks, tissue infiltration, or long-acting local anesthetic formulations, including liposomal bupivacaine. In critically ill surgical patients, however, postoperative ventricular arrhythmias are often multifactorial, and the diagnosis may remain uncertain.

## Case presentation

A 55-year-old man with stage IV chronic kidney disease, hypertension, prosthetic joint infection, and a history of multiple right hip operations underwent hip revision surgery under general anesthesia combined with fascia iliaca block. He received 30 mL of 0.25% ropivacaine for fascia iliaca block, 20 mL of 0.25% ropivacaine for intra-articular injection, and 133 mg of liposomal bupivacaine for wound infiltration. The patient remained intubated and was transferred to the intensive care unit after surgery. At 14:48, approximately 103 minutes after liposomal bupivacaine infiltration and 118 minutes after intra-articular ropivacaine administration, he developed ventricular fibrillation with undetectable arterial pressure. Recurrent ventricular fibrillation and cardiac arrest occurred between 14:48 and 17:41, requiring repeated cardiopulmonary resuscitation, four defibrillations, epinephrine, norepinephrine, amiodarone, correction of metabolic acidosis, blood transfusion, and continuous renal replacement therapy. Intravenous lipid emulsion was not administered. The course was complicated by anemia, coagulopathy, severe hyperlactatemia, infection-related inflammatory response, myocardial injury, and renal dysfunction. The patient was extubated on postoperative day 3. Continuous renal replacement therapy was discontinued on 19 September without subsequent dialysis, vasoactive agents were discontinued on 21 September, and he was transferred to the general ward on 22 September. He was discharged after a 49-day hospitalization.

## Conclusions

The temporal relationship between local anesthetic exposure and ventricular fibrillation made delayed LAST a relevant consideration, but the postoperative collapse was more plausibly multifactorial. In similar high-risk patients, delayed LAST should remain in the differential diagnosis while hemorrhage, acid-base and electrolyte disturbances, infection, myocardial injury, pulmonary embolism, and other competing causes are assessed in parallel.

## Background

Local anesthetic systemic toxicity (LAST) is an uncommon but serious complication of regional anesthesia, peripheral nerve block, and local infiltration analgesia. Its manifestations may involve the central nervous system, the cardiovascular system, or both. Severe cardiovascular toxicity can present with hypotension, conduction disturbance, ventricular arrhythmias, circulatory collapse, and cardiac arrest [1, 6].

The clinical pattern of LAST has become less straightforward as local anesthetics are increasingly used in fascial plane blocks, wound infiltration, and multimodal postoperative analgesia. Delayed presentations have been reported, particularly after tissue infiltration or long-acting formulations [1, 2]. Liposomal bupivacaine is formulated to provide prolonged local release after tissue infiltration. Although it is used to extend postoperative analgesia, published reviews and case reports indicate that systemic toxicity may still occur, including rare presentations with cardiac arrest [2–5].

Postoperative ventricular arrhythmia in a critically ill patient rarely has a single explanation. Hemorrhage, anemia, acid-base and electrolyte disturbances, myocardial ischemia, catecholamine exposure, infection-related shock, pulmonary embolism, and organ dysfunction may all contribute [1, 6]. This overlap makes suspected LAST difficult to identify, especially when plasma local anesthetic concentrations are unavailable.

We describe a patient with stage IV chronic kidney disease who developed recurrent ventricular fibrillation and cardiac arrest after hip revision surgery with exposure to ropivacaine and liposomal bupivacaine. The timing of the arrhythmia made delayed LAST a relevant diagnostic consideration, although the clinical course was complicated by several strong competing causes of cardiovascular collapse.

## Case presentation

A 55-year-old man, 174 cm in height and weighing 65 kg, was admitted with right hip pain and limited mobility for 9 months, with worsening symptoms during the preceding week. He had undergone several right hip operations after trauma, including primary right hip arthroplasty and later revision surgery. The current diagnosis was infection of the right hip prosthesis. His medical history included stage IV chronic kidney disease, hypertension, left ventricular hypertrophy, gout with multiple tophi, and previous cerebrovascular disease.

Preoperative laboratory testing showed severe renal dysfunction, with a serum creatinine concentration of 380  $\mu\text{mol/L}$ , serum urea concentration of 37  $\text{mmol/L}$ , and an estimated glomerular filtration rate of 14.6  $\text{mL/min}$ . The hemoglobin concentration was 107  $\text{g/L}$ . The preoperative electrocardiogram showed sinus rhythm without major abnormality. Transthoracic echocardiography showed preserved left ventricular systolic function, with an ejection fraction of 66%, and mild tricuspid and aortic valve regurgitation.

The patient underwent right total hip revision surgery with spacer removal under general anesthesia combined with fascia iliaca block. On arrival in the operating room, non-invasive blood pressure was 138/79 mmHg, heart rate was 88 beats/min, and oxygen saturation was 98%. General anesthesia was induced with esketamine 10 mg, alfentanil 25 µg/kg, remimazolam 0.4 mg/kg, and rocuronium 0.9 mg/kg, followed by endotracheal intubation. Anesthesia was maintained with remimazolam 0.3–0.4 mg/kg/h, alfentanil 0.3 µg/kg/min, sevoflurane 1–1.5%, and rocuronium 0.5 mg/kg/h. Invasive monitoring included central venous catheterization and arterial catheterization for PiCCO hemodynamic monitoring.

At 08:25, fascia iliaca block was performed with 30 mL of 0.25% ropivacaine, equivalent to 75 mg. After positioning, the operation proceeded with spacer removal and implantation of a new acetabular cup and femoral stem. At approximately 12:50, 20 mL of 0.25% ropivacaine, equivalent to 50 mg, was injected intra-articularly together with betamethasone. At 13:05, the surgeon infiltrated the wound with 133 mg of liposomal bupivacaine. The total dose of ropivacaine was 125 mg (1.92 mg/kg).

The operation lasted approximately 4 hours and 20 minutes. Estimated blood loss was 800 mL, and urine output was approximately 750 mL. Intraoperative fluid therapy included crystalloid, colloid, and 2 units of packed red blood cells. At the end of surgery, the patient remained intubated and was transferred to the intensive care unit with ventilatory support and continuous monitoring.

Early postoperative blood gas measurements showed progressive metabolic stress before the first arrhythmic event. Lactate rose from 0.5 mmol/L at 13:05 to 6.9 mmol/L at 13:53 and 12.6 mmol/L at 14:45. At 14:45, pH was 7.288, arterial carbon dioxide tension was 60.1 mmHg, potassium was 4.4 mmol/L, and ionized calcium was 1.06 mmol/L.

At 14:48, approximately 103 minutes after liposomal bupivacaine wound infiltration and 118 minutes after intra-articular ropivacaine injection, the electrocardiographic monitor showed ventricular fibrillation and arterial pressure was undetectable. Cardiopulmonary resuscitation was started immediately. Intravenous epinephrine was administered, continuous vasoactive support with norepinephrine and epinephrine was initiated, and electrical defibrillation was performed.

Between 14:48 and 17:41, the patient experienced recurrent ventricular fibrillation and cardiac arrest. Repeated cardiopulmonary resuscitation and defibrillation were required, with four defibrillations in total. Amiodarone infusion was given for rhythm control. Treatment also included correction of metabolic acidosis, blood transfusion, volume resuscitation, and vasoactive support. At 14:57, pH was 7.209, lactate was 14.7 mmol/L, potassium was 5.1 mmol/L, and ionized calcium was 0.99 mmol/L. The postoperative course was further complicated by anemia, coagulopathy, infection-related inflammatory response, myocardial injury, and severe renal dysfunction.

At 18:30, a left internal jugular venous catheter was placed, and continuous renal replacement therapy was started to manage severe metabolic disturbance and renal dysfunction. Intravenous lipid emulsion was not administered during resuscitation. No plasma concentrations of ropivacaine or bupivacaine were measured. Severe hyperkalemia was not documented before the first ventricular fibrillation

episode. Pulmonary embolism and acute coronary syndrome remained in the differential diagnosis but could not be definitively confirmed or excluded from the available perioperative data.

After intensive care treatment, no further ventricular fibrillation was documented. The patient was extubated on 12 September. Continuous renal replacement therapy was discontinued on 19 September, and no further dialysis was required. Vasoactive agents were discontinued on 21 September. The patient was transferred to the general ward on 22 September and was discharged on 22 October 2025 after a 49-day hospitalization.

Table 1  
Clinical timeline

| Time/date                       | Event                                                                       |
|---------------------------------|-----------------------------------------------------------------------------|
| 9 September 2025, 08:25         | Fascia iliaca block with 75 mg ropivacaine                                  |
| 9 September 2025, 12:50         | Intra-articular injection of 50 mg ropivacaine with betamethasone           |
| 9 September 2025, 13:05         | Wound infiltration with 133 mg liposomal bupivacaine                        |
| 9 September 2025, 13:20         | Surgery ended; patient transferred to the ICU while intubated               |
| 9 September 2025, 14:48         | First episode of ventricular fibrillation                                   |
| 9 September 2025, 14:48 – 17:41 | Recurrent ventricular fibrillation and cardiac arrest; four defibrillations |
| 9 September 2025, 18:30         | Continuous renal replacement therapy initiated                              |
| 12 September 2025               | Extubated                                                                   |
| 19 September 2025               | Continuous renal replacement therapy discontinued; no subsequent dialysis   |
| 21 September 2025               | Vasoactive agents discontinued                                              |
| 22 September 2025               | Transferred to the general ward                                             |
| 22 October 2025                 | Discharged after a 49-day hospitalization                                   |

Table 2. Selected perioperative blood gas trends

| Time  | pH    | PaCO <sub>2</sub><br>(mmHg) | Na <sup>+</sup><br>(mmol/L) | K <sup>+</sup><br>(mmol/L) | iCa <sup>2+</sup><br>(mmol/L) | Lactate<br>(mmol/L) |
|-------|-------|-----------------------------|-----------------------------|----------------------------|-------------------------------|---------------------|
| 13:05 | 7.287 | 48.2                        | 146                         | 3.9                        | 1.25                          | 0.5                 |
| 13:53 | 7.220 | 42.0                        | 148                         | 4.4                        | 1.27                          | 6.9                 |
| 14:45 | 7.288 | 60.1                        | 158                         | 4.4                        | 1.06                          | 12.6                |
| 14:57 | 7.209 | 53.9                        | 153                         | 5.1                        | 0.99                          | 14.7                |
| 16:35 | 7.381 | 35.4                        | 166                         | 4.9                        | 1.02                          | —                   |
| 17:11 | 7.239 | 58.3                        | 167                         | 4.1                        | 1.17                          | —                   |
| 18:38 | 7.489 | 45.6                        | 164                         | 3.2                        | 1.26                          | 21.0                |
| 20:16 | 7.532 | 46.7                        | 163                         | 3.2                        | 1.27                          | 13.6                |

## Discussion and conclusions

The main diagnostic difficulty in this case was the overlap between the timing of local anesthetic exposure and several severe postoperative insults. The first ventricular fibrillation episode occurred approximately 103 minutes after wound infiltration with liposomal bupivacaine and 118 minutes after intra-articular ropivacaine injection. The patient had also received ropivacaine for fascia iliaca block earlier in the operation. This sequence supports including delayed LAST in the differential diagnosis.

The local anesthetic exposure, however, was not by itself diagnostic. No individual dose was clearly excessive on a weight basis, and plasma concentrations of ropivacaine and bupivacaine were not measured. Because the patient remained sedated and intubated, prodromal neurologic symptoms of LAST could not be assessed. The diagnosis therefore remained presumptive.

Liposomal bupivacaine is formulated for prolonged local release after tissue infiltration. Published reviews and case reports indicate that systemic toxicity may still occur, including rare presentations with cardiac arrest [2-5]. In the present patient, ropivacaine was given before liposomal bupivacaine rather than after it. Even so, the short interval between several amide local anesthetic exposures made additive toxicity a reasonable concern when ventricular fibrillation occurred soon after surgery.

The competing explanations were substantial. The patient had stage IV chronic kidney disease, preoperative anemia, prosthetic joint infection, and major revision surgery. Advanced kidney disease does not establish a causal link to LAST, but it complicates local anesthetic dosing and toxicity assessment, particularly when metabolic disturbances coexist [7]. Importantly, lactate had already risen to 12.6 mmol/L immediately before the first ventricular fibrillation episode, indicating marked physiologic stress before cardiac arrest. Postoperatively, the patient also developed anemia, coagulopathy, infection-

related inflammatory response, myocardial injury, and persistent circulatory instability requiring high-dose vasoactive agents and continuous renal replacement therapy. Any of these factors could have lowered the threshold for malignant ventricular arrhythmia.

Hemorrhage and anemia may have impaired oxygen delivery and contributed to shock. Coagulopathy and wound drainage suggested ongoing bleeding risk. Hyperlactatemia and acid-base disturbance reflected systemic hypoperfusion and may have further destabilized myocardial conduction. Infection-related inflammation and possible septic physiology were plausible given the prosthetic joint infection and postoperative fever with elevated inflammatory markers. Myocardial injury may have resulted from shock, repeated cardiac arrest, defibrillation, catecholamine exposure, or type 2 myocardial infarction. Pulmonary embolism was also relevant after major orthopedic surgery, although it could not be definitively confirmed or excluded from the available data.

Intravenous lipid emulsion was not administered. The 2020 American Society of Regional Anesthesia and Pain Medicine LAST checklist recommends early lipid emulsion therapy for serious LAST and provides a cognitive aid for resuscitation [8]. The absence of lipid therapy limits diagnostic inference based on treatment response. It also reinforces the need for immediate access to lipid emulsion wherever regional anesthesia and local infiltration analgesia are performed.

This case has several limitations. Plasma local anesthetic concentrations were unavailable, neurologic prodromal symptoms could not be assessed, and lipid emulsion was not administered. Several competing causes of ventricular fibrillation were present, including anemia, coagulopathy, marked hyperlactatemia, infection-related inflammation, myocardial injury, and severe renal dysfunction. Pulmonary embolism and acute coronary syndrome could not be definitively excluded.

The temporal relationship between local anesthetic exposure and recurrent ventricular fibrillation made delayed LAST a relevant consideration, but the clinical course is better interpreted as multifactorial perioperative collapse in which suspected LAST may have been one contributor. In patients with similar risk profiles, monitoring beyond the immediate postoperative period and ready access to lipid emulsion may reduce delay in recognition and treatment if LAST is suspected.

## Abbreviations

### **CRRT**

Continuous renal replacement therapy

### **ICU**

Intensive care unit

### **LAST**

Local anesthetic systemic toxicity

### **VF**

Ventricular fibrillation

## **Declarations**

## **Ethics approval and consent to participate**

According to the institutional policy of Guangzhou Red Cross Hospital, ethics approval was not required for this single anonymized case report. Consent to participate was not applicable.

## **Consent for publication**

Written informed consent for publication of this case report and the patient's anonymized clinical information was obtained from the patient.

## **Availability of data and materials**

The clinical data supporting this case report are available from the corresponding author on reasonable request, subject to institutional regulations and patient privacy protection.

## **Competing interests**

The authors declare that they have no competing interests.

## **Funding**

This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

## **Authors' contributions**

HQ and JK contributed to case analysis, manuscript drafting, and literature review. WP contributed to clinical data collection and case interpretation. AW supervised the case analysis, reviewed the manuscript, and provided critical revisions. All authors read and approved the final manuscript.

## **Acknowledgements**

The authors thank the intensive care, orthopedic, and cardiology teams involved in the multidisciplinary management of this patient.

## **References**

1. Macfarlane AJR, Gitman M, Bornstein KJ, El-Boghdadly K, Weinberg G. Updates in our understanding of local anaesthetic systemic toxicity: a narrative review. *Anaesthesia*. 2021;76(Suppl 1):27–39. 10.1111/anae.15282.
2. On'Gele MO, Weintraub S, Qi V, Kim J, Local Anesthetics. Local Anesthetic Systemic Toxicity (LAST), and Liposomal Bupivacaine. *Anesthesiol Clin*. 2024;42(2):303–15. 10.1016/j.anclin.2023.11.011.
3. Belfar AL, Nguyen PN, Feng BH. Local anaesthetic systemic toxicity presenting as cardiac arrest after subcutaneous infiltration of liposomal bupivacaine. *Br J Anaesth*. 2025;135(1):232–3. 10.1016/j.bja.2025.03.030.
4. Boleyn J, Hardie K, Burt MR, Wieman S. Local Anesthetic Systemic Toxicity During Transversus Abdominis Plane Block With Liposomal Bupivacaine. *Am Surg*. 2023;89(11):4252–4. 10.1177/00031348231206578.
5. Tran BW, Liebman ST, Reichman TW, Scott MJ. Hemodynamic instability and lipid emulsion resuscitation after subcutaneous injection of a liposomal bupivacaine admixture: a case report. *Pract*. 2019;12(7):223–5. 10.1213/XAA.0000000000000889.
6. Long B, Chavez S, Gottlieb M, Montrieff T, Brady WJ. Local anesthetic systemic toxicity: A narrative review for emergency clinicians. *Am J Emerg Med*. 2022;59:42–8. 10.1016/j.ajem.2022.06.017.
7. Uppal NN, Jhaveri M, Hong S, Shore-Lesserson L, Jhaveri KD, Izzedine H. Local anesthetics for the Nephrologist. *Clin Kidney J*. 2022;15(2):186–93. 10.1093/ckj/sfab121.
8. Neal JM, Neal EJ, Weinberg GL. American Society of Regional Anesthesia and Pain Medicine Local Anesthetic Systemic Toxicity checklist: 2020 version. *Reg Anesth Pain Med*. 2021;46(1):81–2. 10.1136/rapm-2020-101986.

## Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- [CAREChecklist.docx](#)