Local Anesthetic Systemic Toxicity: A Pediatric Simulation Case for Anesthesiology

Residents

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ABSTRACT

Since 2017, a simulation lab has been conducted in order to train IUSM anesthesiology residents on a case of pediatric LAST.

A 15-question survey was sent to the most recent 2 cohorts of residents, revealing that most participants were knowledgeable about the treatment of LAST and knew the pediatric dosing, but still reported finding the simulation valuable for boosting their skills, knowledge, and confidence.

Teaching about LAST is critical for all anesthesiology residents, as this is a rare but can't-miss diagnosis. This simulation scenario is a useful and broadly applicable resource to allow residents to practice this critical learning, and residents consistently provide positive feedback about their experience.

BACKGROUND

- Local anesthetic systemic toxicity (LAST) is a rare but potentially lethal complication of anesthesia.*
- LAST likely occurs in approximately 1-1.8 cases per 1000 nerve blocks, and presentations are becoming more delayed with increased use of ultrasound guidance, local infiltration anesthesia, and continuous local infusion .*
- Simulation provides an optimal environment for trainees to practice rare and life-threatening events.*
- LAST is more difficult to catch under general anesthesia, making this a useful simulation.*

MATERIALS & METHODS

- Requires access to a human patient simulator and a full OR setup.
- Ideally, other roles should be paid participants. If needed, other trainees can hold these roles and receive instructions through an earpiece. This is usually required at our institution.
- A 2-year-old male undergoing hypospadias repair with a caudal block develops LAST after induction.
- Trainees receive a patient handoff, complete the case, and then participate in a debriefing session and survey.
- Trainees can call for and use the ASRA LAST checklist.
- Following the simulation, participants were debriefed with good intention and completed a survey in which they rated responses on 4 and 5-point Likert scales and answered questions specific to the ASRA checklist and pediatric Intralipid dosing.

RESULTS

- At the time of submission, 5 cohorts of anesthesiology residents have completed this simulation, with 25-28 residents per cohort. Data is available for only the last 2 years (2020 and 2022, as 2021 was missed due to COVID-19). See Table 1.
- 30 residents have completed the post-simulation survey. In the most recent survey, 21 of the 26 residents completed the survey for a response rate of 77%.
- Most respondents indicated that they found this simulation to be valuable, that they felt their skills and confidence had improved, and that they had benefitted from the debriefing.
- 67% (16/24) indicated that they had used the ASRA checklist
- 39% (7/18) stated that they had to look up the specific pediatric dosing of lipid emulsion
- 80% (12/15) stated that they found the checklist to be helpful
- 63% (15/24) of all respondents stated that they would use a checklist if they encountered LAST in the future

DISCUSSION

- Simulation allows trainees to practice rare but life-threatening events that may not otherwise be encountered over the course of clinical residency training.
- Residents consistently report positive feedback regarding improvements in their knowledge and confidence.
- Faculty must have supported nonclinical time to run simulation, but the consistently positive feedback by residents validates this use of faculty time.
- Future data collection may include a follow-up survey of CA2 residents to assess knowledge retention.
- Limitations: difficult to evaluate demonstrable clinical change.
  - Participation in one simulation improves a trainee's performance in a future similar simulation,* an unsurprising result that theoretically would translate to clinical performance as well.
- **Conclusion: This simulation scenario is useful and broadly applicable and allows anesthesia trainees to practice critical LAST treatment in a psychologically safe environment.**

Table 1. Distribution of Responses, Item Mean Scores, and Standard Deviations

Item	Percentage (%)			*M*	*SD*
	Agree[b]	Neutral	Disagree[c]		
The LAST simulation improved my ability to diagnose LAST on a pediatric patient under general anesthesia[a]	85	0	15	1.7	1.1
The LAST simulation was a valuable experience[a]	93	0	7	1.3	0.8
The LAST simulation improved my confidence in correctly dosing Intralipid on a pediatric LAST patient[a]	92	0	8	1.5	0.9
The LAST simulation improved my ability to effectively communicate during a LAST situation[a]	89	6	6	1.5	0.9
The LAST simulation improved my confidence in being able to apply these LAST principles to an adult patient[a]	96	0	4	1.5	0.7
The LAST simulation improved my confidence in performing Pediatric Advanced Life Support (PALS) on a pediatric LAST patient[a]	92	4	4	1.5	0.8
The anesthesia faculty/staff provided a psychologically safe learning environment during the debriefing[a]	100	0	0	1.1	0.3
The anesthesia faculty/staff discussed important LAST clinical topics during the debriefing[a]	100	0	0	1.0	0.2
The anesthesia faculty/staff asked useful questions to facilitate learning during the debriefing[a]	100	0	0	1.0	0.2
	Yes	**No**			
Did you use a checklist during the LAST simulation?	67	33			
Did you have to look up the pediatric dosing for Intralipid on the previous question?	39	61			
	Helpful	**Intermediate[e]**	**Not Helpful**		
How helpful was the checklist in treating the patient?[d]	80	20	0	1.2	0.4
	Likely[g]	**Neutral**	**Unlikely[h]**		
How likely are you to use a checklist during a future LAST scenario?[f]	92		8	1.5	0.9
	Effective	**Neutral[j]**	**Ineffective**		
Please rate the anesthesia faculty/staff's effectiveness in advancing resident learning during the debriefing[i]	92	8	0	1.1	0.3
	Correct	**Incorrect**			
Please write the pediatric dose for the initial Intralipid bolus:	95	5			

[a]Rated on a 5-point Likert scale (1 = *strongly agree*, 2 = *somewhat agree*, 3 = *neither agree nor disagree*, 4 = *somewhat disagree*, 5 = *strongly disagree*).
[b]Strongly agree, somewhat agree
[c]Strongly disagree, somewhat disagree
[d]Rated on a 4-point Likert scale (1 = *extremely helpful*, 2 = *moderately helpful*, 3 = *somewhat helpful*, 4 = *not helpful at all*).
[e]Moderately helpful, somewhat helpful
[f]Rated on a 5-point Likert scale (1 = *extremely likely*, 2 = *somewhat likely*, 3 = *neither likely nor unlikely*, 4 = *somewhat unlikely*, 5 = *extremely unlikely*).
[g]Extremely likely, somewhat likely
[h]Extremely unlikely, somewhat unlikely
[i]Rated on a 4-point Likert scale (1 = *very effective*, 2 = *somewhat effective*, 3 = *neither effective nor ineffective*, 4 = *very ineffective*).
[j]Somewhat effective, neither effective nor ineffective

*References available upon request