Acting Fast When the Diagnosis is Local Anesthetic Systemic Toxicity (LAST)

ASPAN'S 41ST NATIONAL CONFERENCE
APRIL 7-10, 2022
DOLLY IRELAND, MSN, RN, CAPA, CPN, FASPAN

1

Historical Background

- 1904 development of Procaine did not solve problem
- Committees formed to study effects of local anesthesia toxicity

Studies published reported 43 fatal cases

2

Hisorical Perspective

History characterized by a pattern of:

Discovery

Application

Observation

Innovation

1997-1998 new studies

3

History cont.

1997 – Dr. G. Weinberg and several colleagues championed the study of toxicity and its effects.

- Reported first case of 16 yr. old who received general anesthesia with a local of bupivacaine and epinephrine. Normal EKG (NSR) progressed to junctional bradycardia to wide complex ventricular dysrhythmias.
- Literature showed a continued relationship between local anesthetics and occurrence of cardiac and CNS toxicity.

4

History cont.

- 2006 – first successful use of a 20% lipid infusion in a patient experiencing cardiac arrest following an interscalene block with bupivacaine/mepivacaine.
- After 20 minutes of unsuccessful CPR, lipid emulsion was administered and within 15 sec returned to NSR
- Dr. Weinberg voiced concerns back in 2015 that use of lipid emulsion was dropping, case reports were declining.

5

Resource

Website:

Lipidrescue.org

6

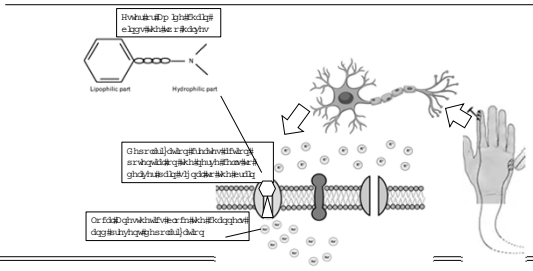
Local Anesthetics

Advantages
- Postop analgesia at site
- Safe for patients with systemic disease
- Fewer S/E (PONV, sedation, resp. depression)

Disadvantages
- Toxicity
- Allergic reactions
- IV injection
- Inadvertent infiltration

7

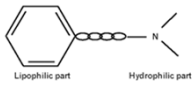
Local Anesthesia



8

Local Anesthesia

Esters-cocaine, procaine, tetracaine
- Metabolized by pseudocholinesterase
  - Process releases para-aminobenzoic acid (PABA)
    - Some people are allergic to that



Amides-bupivicaine, lidocaine, mepivacaine,
- Metabolized in liver

9

Esters

Cocaine
- Topical only
- ENT cases-vasoconstriction
- CNS Stimulant
- Toxicity:
  - Increases BP, HR, temperature
  - CVA, coronary artery vasoconstriction
  - Decreased fetal blood flow

Procaine
- Local, block, spinal

Chloroprocaine
- Stronger but shorter duration than Procaine
- Local, block, epidural
- Duration 30-60 minutes

Tetracaine
- Local, block
- Slow onset, long duration
- Eyes, tracheal topical

10

Amides

Mepivacaine
- Local, block, epidural. NOT spinals
- Longer acting than Lidocaine
- Does not cause vasodilation

Ropivacaine
- Epidural
- Safe for OB use
- 12 hours duration

Bupivacaine
- Local, block, spinal, epidural
- Long duration
- Analgesia after anesthetic effect resolved 4 to 8 hr

Etidocaine
- Local, block, epidural
- 5-10 hours duration
- Local

11

cal Anesthetics Used for Regional Techniques.

ug	Onset	Duration (min)	Local	Topical	IV Block	Peripheral	Epidural	Spinal	Maximum Dose/Extra Information
STERS									
caine	Rapid	10–55	No	Yes	No	No	No	No	150 mg or 3 mg/kg Only local that constricts
caine (Novocain)	Slow	15–30	Yes	No	No	Yes	No	Yes	1000 mg Increased incidence allergic reactions
loroprocaine (Nesacaine)	Rapid	15–30	Yes	No	No	Yes	Yes	No	600–800 mg Permanent neural damage with EDTA additive (SAB)
racaine (Pontocaine)	Slow	120–240	No	Yes	No	No	No	Yes	100 mg 20 mg max in SAB Most potent local
MIDES									
docaine (Citanest)	Slow	60–120	Yes	No	Yes	Yes	Yes	No	>600 mg leads to methemoglobinemia High lung uptake
docaine	Rapid	60–120	Yes	Yes	Yes	Yes	Yes	Yes	300 mg or 5 mg/kg (7 mg/kg with epinephrine); CNS toxic; CES
pivacaine (Carbocaine)	Slow	45–90	Yes	No	No	Yes	Yes	No	300 mg Great for peripheral nerve blocks
pivacaine (Marcaine and Sensorcaine)	Slow	120–240	Yes	No	No	Yes	Yes	Yes	175 mg or 3 mg/kg 20 mg max SAB CV toxic
docaine (Duranest)	Slow	240–480	Yes	No	No	Yes	Yes	No	300 mg Profound motor (not for OB) Surgical usage only
pivacaine (Naropin)	Rapid	240–360	Yes	No	Yes	Yes	Yes	Yes	200 mg Less motor block than bupivacaine; less CV toxic as well
vobupivacaine	Slow	240–480	Yes	No	No	Yes	Yes	Yes	Structurally related to bupivacaine

12

Amides

Lidocaine
- Topical, block, spinal, epidural, Bier block
- Rapid onset
- Depresses reflexes trachea and larynx
- Duration 1.5-2 hours

Prilocaine
- Local, block, IV, epidural
- Metabolism releases ortho-toluidine

Converts hemoglobin to Methemoglobin
- Methemoglobinemia S/S
  - Darkened urine and blood
  - Tachypnea
  - Metabolic acidosis
  - Hypoxia
- Treatment
  - Methylene blue
    - 1-2 mg/kg
  - Can repeat

13

Allergic Reactions

SIGNS and SYMPTOMS	*TREATMENT*
• rash	• oxygen
• pruritus	• airway management
• laryngeal edema	• fluid support for hypotension
• hypotension	
• bronchospasm	

THESE ARE ALLERGIC REACTIONS – ACT NOW!

14

Toxicity

CV: mild to severe
- HTN, Tachycardia
- Decreased cardiac output, mild hypotension
- peripheral vasodilation, hypotension, bradycardia, circulatory collapse

can occur twenty minutes after injection

15

Local Anesthetic Toxicity

Causes: excessive dose or injection into very vascular area

CNS: mild progressing to severe
- Tingling around the mouth
- Dizziness, drowsiness, confusion, tinnitus
- Tremors of face, extremities, tonic-clonic seizures
- Unconsciousness, respiratory arrest

16

Treatment of Toxicity

TREATMENT
- Early detection
- Support circulation with fluids, vasopressors antiarrythmics
- Oxygen, airway management
- Control of seizure activity
- BLS/ACLS management if necessary
- LIPID INFUSION

17

ASRA

American Society of Regional Anesthesia and Pain Medicine

•Published a treatment checklist in 2012 that includes 4 specific factors to follow:

1. Get Help!
2. Initial focus – (a) airway; (b) seizure suppression
3. Manage cardiac arrhythmia's
4. Lipid Emulsion

(report and publish lipid rescue and use)

18

What Goes Wrong????

LOCAL ANESTHETIC

- injected intravascular
- absorbed from tissue depot
- repeated doses given without balanced elimination

What happens when large amounts of local anesthetic contact nerve and heart cells?

19

Excitation

Central Nervous System
(may be subtle or absent)

- Circumoral Numbness
- Metallic Taste
- Ringing in Ears
- Agitation
- Confusion
- Muscle Twitching
- Seizure

Cardiac System
(may be only manifestation or severe LAST)

- Hypertension
- Tachycardia
- Ventricular Arrhythmias
- Ventricular Tachycardia
- Torsade de Pointes
- Ventricular Fibrillation

20

Depression

Central Nervous System

- Drowsiness
- Obtunded
- Respiratory Depression/Arrest
- Coma

Cardiac System

- Diaphoresis
- Hypotension
- Lightheadedness
- Shortness of Breath
- Chest Pain
- Conduction Block
- Bradycardia
- Ventricular Arrhythmias
- Asystole

21

Local Anesthetic Sytemic Toxicity

Consider *LAST* in any patient with altered mental status, neurological symptoms or cardiovascular instability after regional anesthetic

22

Treatment of LAST

- Aggressive airway management to avoid hypoxia, hypoventilation, and tissue acidosis, which all exacerbate LA induced cardiovascular depression.
- If they occur, seizures should be quickly stopped with benzodiazepines, if they persist consider small doses of succinylcholine or similar neuromuscular blocker.
- **LIPID THERAPY SHOULD BE STARTED IMMEDIATELY**

23

Lipids Mechanism of Action

- Local anesthetics are lipophilic
- Infusing the lipids cause a "lipid sink" where the LA binds to and lipids absorb the LA
- The LA can then be safely carried to the liver where it is metabolized and excreted from the body

24

Monitoring post-treatment

Prolonged monitoring (>12 hours)is recommended after any signs of systemic LA toxicity, since cardiovascular depression due to local anesthetics can persist or recur after treatment.

25

Case Studies

Dr. Weinberg – www.lipidrescue.org

Study #1 –Healthy 35 y female, ASA 1, egg allergy. MAC anesthesia for a breast mass. Uncomplicated OR case. Pt received 2mg Versed, 50mcg Fent, Propofol and Zofran during case. 40cc of 1% Lidocaine w/o epi given for local at the beginning of the case (aspiration q 5cc), Pt transported to PACU. During transport pt began having jerking motions of upper and lower extremities lasting 10-20sec with 30 sec- 2min of inactivity. Pt awake and apologetic – saying "they are out of my control". Mental status begins to deteriorate. Pt tachy in the 110's, saO2 fine on 2l/NC. Pt given bolus of 120cc of 20% intralipid over 15 min. By end of bolus, VSS, sleepy but A&Ox3. Neurololgy consult agreed that this was likely CNS toxicity. Symptoms completely resolved, pt monitored in PACU for 5 hrs and then transferred to floor.

26

Case Studies

Study#2 17yo male, ASA1, 6ft 197#, pt received 2mg Versed and 50mcg Fentanyl, ACL reconstruction under G with a Fem-Sciatic pain block. Standard monitoring and O2 via 2L/NC. Stimuplex needed with stimulation was used. Fem block placed: 0.5% Bupivicaine with Epi in 5cc increments with neg blood aspiration. Pt received 50mcg of Fen to reposition leg, same procedure was used for the sciatic block, same Bupivicaine mix was used and 5ml doses were given up until 15mls. During next 5mls pt states "I can't breathe". Injection stopped immediately (total 18mls given). Pt began exhibiting seizure activity, 2mg versed given, seizure cont and getting worse. Intralipid infusion started (wide open). After 75-100 ml infused seizure activity stopped, pt responding. After 200ml pt was sedate but A&Ox3. Monitored for 3+ hours prior to discharge.

27

FINAL THOUGHTS

- IF YOU ARE FOLLOWING LIPID PROTOCOLS WHEN YOU GIVE LOCAL BLOCKS – KUDOS maybe this served as a good review. Important to have those lipids on your block cart.
- IF YOU ARE NOT -----OR-----THIS IS THE FIRST TIME YOU HAVE HEARD OF THIS… PLEASE THINK ABOUT GENERATING SOME DISCUSSION WITHIN YOUR ANESTHESIA DEPARTMENT.

lipidrescue.org

28