TUMESCENT ANESTHESIA

TUMESCENT ANESTHESIA I
- The concentration of Lidocaine and Epinephrine depends on the treatment area.
- Total drug dosage depends on the patient's weight, mg/kg ratio.
- Dose: Quantity of medicine given in time, measured in mg.
- Important to minimize side effects.

HISTORY
- 1920 Hypodermoclysis for fluid replacement and drug administration
- 1920 The addition of epinephrine to the anesthetic solution to cause vasoconstriction and to prolong the local anesthetic effect
- 1924 Massive infiltration analgesia with weak analgesic solutions for anesthesia
- 1933 Pressurized and motorized infusion pumps
- Long flexible needles and an on/off handle to control the anesthetic flow

A. V. VISCHNIEVSKY
- Hydraulic preparation of the tissues.
- The first and most important rule after infiltration is to wait until the anesthesia spreads.
- The tumescent technique is as important as the surgery technique.

TUMESCENT ANESTHESIA II
- Maximum dosage of tumescent lidocaine with epinephrine is a concentration between 0.05% and 0.1%, this up to 45mg/kg.
- The traditional concentration of lidocaine with epinephrine at 0.5%, 1% or 2% is of 7 mg/kg.

TUMESCENT ANESTHESIA IV
- The medic has to write down how to perform the tumescent anesthesia.
- Know the weight of the patient.
- Maximum dosage in mg/kg.
- The exact quantity of each drug that will be included in the tumescent solution in mg/L or meq/L.
TUMESCENT ANESTHESIA V
- The team must know the dosage used in mg and the mg/kg ratio.
- The solution must specify the quantity of lidocaine and epinephrine (mg/lit) and the quantity of meq./lit of bicarbonate.
- It is easier to work in mg/lit.
- Lidocaine to 1% - Conservatism!!

TUMESCENT ANESTHESIA V
- Train the person that will prepare the TA.
- Eyes-on or hands on supervision
- Prepare the solution in the operating room immediately before the each surgery.
- Store the empty ampoules.
- No Diazepam in the 24 hours. Post-op.

TUMESCENT ANESTHESIA VI
- We prefer the normal saline solution.
- The anesthetist must be present.
- Must know the TA.
- Must write down everything that it is applied to the patient.
- Must be careful with the dosage that is written specially if it is associated with another type of anesthesia.

TUMESCENT ANESTHESIA VII
- Lidocaine and epinephrine-concentration in accord with the clinical requirements.
- Years of experience and precise observation have helped us to evaluate the ideal concentration.
- The “goal” is to achieve the minimum concentration for each component that allows us to operate without causing any pain.

TUMESCENT ANESTHESIA VIII
- Fibroses Areas: abdomen sup., breast, posterior hip area; associated with more bleeding. Need more.
- Microcannulas: Less pain.
- If you use microcannulas, that allow for the use of less concentration of drugs and produces less discomfort.

TUMESCENT ANESTHESIA IX
- If we treat a number of different areas the same day, we must use the minimum concentration in order not to exceed the security limits of the dosage. (mg/kg).
- Epinephrine = Adrenaline
TUMESCENT ANESTHESIA XI
- Epinephrine is an alfa and beta agonist
- Cause Increase of Cardiac Work and peripheral VC and increase of the arterial pression
- Tumescent anesthesia is a powerful capillary vasoconstrictor producing a good hemostasia

TUMESCENT ANESTHESIA XI
- Antecedents of Adverse history with epinephrine.
- Not the same as in odontology.
- Patients that use nasal drops (with pseudoephedrine), dietary supplements with ephedrine, can lead to tachicardy.
- Metabolic disorders, hyperthyroidism, feocromocitomas
- Patients with hidden cardiac pathologies (mitral prolapse).

TUMESCENT ANESTHESIA XII
The TA has minimum risks if
- Limit the quantities to small volumes.
- If there are no problems, you can continue on the following days.

TUMESCENT ANESTHESIA XIII
- There are variations in the concentration of the epinephrine according to the areas.
- Fibrosis Zones: 1mg/liter of solution.
- Fat Zones:0.65mg/liter
- Beta blockers and epinephrine interact producing an adverse reaction blocking the Beta receptors and stimulating the Alfa receptors: Hypertension crisis.

TUMESCENT ANESTHESIA XV
- Epinephrine is injected, in 5 to 15’ will produce the blanching and VC.
- There were no problems with patients that use beta blockers with TA.
- Low absorption of the TA.
- The method to introduce the drug and the ratio of absorption are decisive.
TUMESCENT ANESTHESIA XV
- The systematic slow absorption of the epinephrine in the TA causes that the risks of an adverse reaction due to interaction of epinephrine and the beta blockers to be minimum.
- Although we haven’t had a problem with a patient, we have to assume that we will have problems with the next one, so, be always ready and on guard.

TUMESCENT ANESTHESIA XVI
- The Tumescent solution must be prepared before the surgery in the OR, it mustn’t be stored if prepared, because the lidocaine will decant and the epinephrine becomes unstable to a pH > 5 and light.

TUMESCENT ANESTHESIA XVII
- Never add Bicarbonate of Sodium to the Bupivacaine, PRODUCES IMMEDIATE DECANTATION.
- If you injected by Intradermal or Subcutaneous it can produce necrosis to the dermis.

TUMESCENT ANESTHESIA XVIII
- Klein use triamcinolone 10 mg / lt. To reduce the incidence of the local inflammation.
- Normal Saline Solution (0.9 %CLNa), According to the pharmacopoeia of the USA, it contains 154meq./lt of sodium and chlorine. The plasma contains 142meq.Na./lt.

TUMESCENT ANESTHESIA XIX
- The NaHCO3 10meq/lt is added to the lidocaine solution to neutralize the pH and reduce the pain when the lidocaine is infiltrated in subcutaneous form.
- That means that 1 liter of tumescent solution contains 164meq of Na.

TUMESCENT ANESTHESIA XX
- Ringer lactate (USP)
  - 130meq/l Na
  - 109meq/l Cl
  - 29 meq/l lactate
  - 4meq/l K
  - 2,7meq/l calcium
TUMESCENT ANESTHESIA XXI

- The adult body produces 1200-1500mmol of lactate per day (50 -60 mmol/hour), the liver metabolizes 60% and the kidney metabolizes and excrements the other 40%.
- Big quantities: alkalois
- Predisposes to a TVP TVP
- Cardiac Arritmias
- Reduces the vagal pain.

Medications potentially causing lidocaine toxicity

Inhibitors of cytochrome p450 3a4 (cyp3a4) compete with lidocaine as substrates for this enzyme

Lidocaine toxicity

- Lidocaine is rapidly and almost exclusively eliminated by p450
- If lidocaine is not metabolized the blood level will rise following tumescent infiltration.

Lidocaine toxicity

- Patients should be carefully questioned about medications being taken prior to surgery.
- Commonly used drugs are cimetidine, flurazepam and thyroxine.
- Cardiac medications may include amiodarone, diltiazam, metoprolol, nifedipine and verapamil

Lidocaine toxicity

- Patients may be on antibiotics or placed on preop.antibiotics

- Avoid
  - Chloramphenicol
  - Clarithromycin
  - Erythromycin
  - Tetracycline
  - Metronidazole
  - Miconazole

Drugs which inhibit cytochrome p450

- Amiodarone, carbamazepine(tegretol), cimetidine
- Danazol, dexametasona, fluoxetine (prozac)
- Flurazepam, itracaanazole, ketaconazole.
- Chloramphenicol, clarithromycin, erythromycin
- Metronidazole, nifedipine, pentoxifylline

- Propofol, terfenadine, thyroxine
  - Plasma half life
  - Fluoxetine: 1-3 days  4-- 6 days
  - Propofol: 1-3 days
- Nifedipine: 9 hs.
- Metronidazol: 8hs

CYP 3A4 Inhibitors

- Benzodiazepines
  - Alprazolam
  - Diazepam
  - Flurazepam
  - Midazolam
  - Triazolam

- Calcium Channel Blockers
  - Amiodorone
  - Ditiazam
  - Felodipine
  - Nicardipine
  - Nifedipine
  - Verapamil

Categories of CYP 3A4 Inhibitors Potentially affecting Lidocaine

- Anti-fungal Medications
  - Fluconazole
  - Itraconazole
  - Ketoconazole
  - Miconazole

- Anti-seizure Medications
  - Carbamazepine
  - Divalproex
  - Valproic acid

CYP 3A4 Inhibitors

- Macrolide Antibiotics
  - Clarithromycin
  - Erythromycin

- Protease inhibitors
  - Ritonavir
  - Indinavir
  - Saquinavir
  - Nelfinavir

- SSRI antidepressants
- Flouxetine
- Fluvoxamine
- Nefazodone

CYP 3A4 inhibitors

- Drugs for cholesterol
  - Cervivastatin
  - Atorvastatin
  - Lovastatin
  - Simvastatin

**Drug metabolized by cytochrome P450 3A4**

- Alprazolam, amiodarone, amlodipine, astemizole, atorvastatin, carbamazepine, cerivastatin, cimetidine, cisapride, cyclosporine, danazol, dexamethasone, diltiazem, erythromycin, felodipine, fluoxetine, fluconazole, flurazepam, fluvoxamine, grapefruit juice, imipramina, indinavir, itraconazole, isoniazid, isradipine, ketoconazole, losartan, lovastatin, methadone, methylpredinosolone, metronidazol, miconazole, mibefradil dihydrochloride, midazolam, nefazodone, nelfinavir, nicardipine, nifedipine, norfloxacin, paroxetine, omeprazole, pentoxifylline, propafenone, propanolol, quinidine, ritonavir, sertraline, sildenafil, simvastatin, tamoxifen, terfenadine, tetracycline, theophylline, thyroxine, triazolam, troglitazon, troleandomycin, valproic acid, verapamil

**ADVERSE EFFECTS**

- Fatal and near fatal pulmonary edema.
- Recently been reported.
- Complications of the tumescent technique.
- Increased hydrostatic intracapillary pressure, altered alveolar capillary membrane permeability, and a decrease in plasma oncotic pressure

**ADVERSE EFFECTS II**

- Lidocaine is an amida-type of local anesthesia.
- Blocks nerve conduction.
- By altering membrane permeability to sodium.
- Depresses diastolic depolarization
- And ventricular automaticity by direct suppression of myocardial cellular function

**ADVERSE EFFECTS III**

- Two active metabolites contribute to lidocaine’s therapeutic and toxic effects
  - Monoethylglycinexylidide megx
  - Glycinexylidide gx
Decreased cardiac output
↑ Lidocaine half life
↓ Volume of distribution
Increase plasma levels

Liver disease
↑ Lidocaine half life
↓ Protein binding
Increase plasma levels

Kidney disease
Significant only if severe impairment

Obesity
↑ Lidocaine half life
↓ Volume of distribution

Advanced age & sex
Men: ↑ half life in elderly
Women: half life & volume of distribution independent of age

Oral contraceptives
↑ Free unbound lidocaine by ↓ a1-acid glycoprotein (aag)

Beta blockers
↓ cardiac output and hepatic blood flow,
↓ Lidocaine clearance.
↑ plasma lidocaine levels by 20% to 30%

Tricyclic antidepressants
↑ Epinephrine activity

Anorexiants
↑ Epinephrine-like activity

Hypokalemia
↓ Cardiac output
↑ Cardiac arrhythmia potential

Hypophosphatemia
↓ O2 carrying capacity of red blood cells
↓ Cardiac output
↓ Pulmonary ventilation
Hypoalbuminemia  
↑ Unbound (active) lidocaine  
↑ Fluid shift to extra vascular tissue  
Excess fluid volume or rate of administration  
Dilution of intravascular contents  
(E.g. hypoalbuminemia, hypoosmolality, hypokalemia, etc)  
Propocol  
↓ Cardiac output  
Cimetidine  
↑ Lidocaine half life  
↓ Protein binding  
↓ Lidocaine clearance 30%

PRACTICAL CONSIDERATIONS I

- Volume is limited to 3000ml TO 5000ml.
- Lidocaine not exceeding 35 mg/kg of body W
- Patient without any potential as morbid conditions or risk factors.
- Patients with one or two morbid conditions or risk factors be considered for a less volume.
- Administer the tumescent formula in increments (500ml) separated by procedure site or area to be suctioned.

PRACTICAL CONSIDERATIONS II

- Begin procedure within 15-20 minutes after completion of injection.
- Patient with a history of taking certain categories of medications should be cleared by appropriate medical specialists. Diet drugs, cardiovascular, endocrine, antipsychotic, antidepressant.
- Patients with eating disorders or extreme alterations in diet or nutritional habits should also be cleared by a specialist.

TO MINIMIZE THE RISK OF TUMESCENT MEDICATION ERRORS

- Use safety labels to identify the patient, the bag number and to unambiguously identify its content.
- Do not prepare tumescent anesthesia solution without a written detailed medication order signed by surgeon.
- Dosages of lidocaine and epinephrine should be specified in terms of milligrams.
- Write patient’s name on safety label & apply label to bag.
- Immediately after adding a drug into bag, circle the milligram dose printed on label.
MINIMIZE RISK II
- Avoid medication errors by mixing only one bag at a time. Then set the filled bag aside before mixing the next bag.
- Do not permit distractions or conversation while mixing bags.
- If there is any doubt about a bag’s content, discard the bag, and mix a new bag.
- Save the empty drug bottles, vials, and containers until the case is completed, so that if there is any question about the dosage, one can check to be certain that the number of empty drug containers corresponds to the correct amount of drug in the bags.

MINIMIZE RISK III
- Record the exact amounts of administered lidocaine, and volumes of parenteral fluids.
- Ex. Safety labels bag:
  - For subcutaneous tumescent infiltration only
  - Lidocaine 250mg 500mg 750mg 1000mg …………mg
  - Epinephrine 0,5mg 0,65mg 1mg 1,5mg …………mg
  - Na Bicarb 10 meq. In 1000 ml 0,9%NaCl
  - Patient’s name date

BUPIVACAINE
- Longer action than Lidocaine
- With epinephrine 27% more
- Decrease of myocardium function
- Decrease of the contraction
- Decrease of the cardiac frequency
- Coronary VC
- Inhibition of alfa 2 adrenergic receptors

BUPIVACAINE
Don’t use in tumescent anesthesia, is dangerous
It produces fatal arrhythmias, 6 times more toxic than Lidocaine

PRILOCAINA
- Acts faster than Lido
- Fast hepatic metabolism and also in kidneys
- Safe drug in healthy patients
No studies on large amount of drug
No FDA approval

ARTICAINE
- Is the most widely used local anesthetic agent in dentistry.
- Amide structure is similar to that of other local anesthetics.
- Contains additional ester group
  - Which is quickly hydrolyzed by esterases
- The time to maximum drug concentrations
  - Occurs about 10 to 15 minutes
- After submucosal injection of articaine 4%80mg
- The mean maximum plasma drug concentration
  - 400 mug/l articaine w/epinephrine 1:200000
  - 580 mug/l articaine w/out/epi

ARTICAINE
- The elimination half time is about 20’
- The rapid breakdown of the articaine to the inactive metabolite articainic acid
  - Is related to a very low systemic toxicity
  - Consequently to the possibility of repeated injections
- Equal analgesic efficacy along with lower systemic toxicity
  - Permits the use of articaine in higher concentrations that other amide type local anesthetics
- Complete anesthesia
  - Can be observed in nearly 90% of all cases
- Using articaine 4% 60-80 mg with epi 1:200000
- Is better able to diffuse through soft tissue and bone that other local anesthesia.
- The plasma protein binding rate of articaine and articainic acid is 70%
- It has been concluded that an unintentional intravascular injection of articaine 80 mg does not cause toxic effects in healthy individuals.

ARTICAINE
- Carticaine
- Septocaine
- Dosing
  - Infiltration dental anesthesia in adults
- 0,5 to 2,5 ml of 4% w/epi
- up 3.4 ml. Is given for nerve block
– Oral surgery
   - 1 to 5.1 ml is given
   - Epidural anesthesia
   - 30 ml 2% w/out/epi
     - Intravenous regional anesthesia (upper limb surgery)
40 ml of 0.5% administered over 0.5 to 2 minutes

Peak plasma levels occur approximately 15 minutes after dental infiltration
- Is metabolized predominantly via plasma and tissue esterases to an inactive metabolite
- Some hepatic metabolism may occur
- Should be stored at 25°C (77°F)
- Protect from light and freezing
- Rapidly hydrolyzed by blood and tissue esterases (up to 90% combined) to articainic acid.
- Liver 5 to 10%
  - Cytochrome P450 isoenzyme system 5 to 10%

Metabolites
- Articainic acid
- Plasma
- Inactive
  - Articainic acid glucuronide
- Urine
- Inactive

Contraindications
- Prior hypersensitivity to amide local anesthetics
- Prior hypersensitivity to sodium metabisulfite
- Infection at site of injection
- Shock (potential for exacerbation)

- Is an intermediate-duration
- Amide-type local anesthetic agent
- Its amide structure is similar to that of lidocaine, etidocaine and prilocaine
- But differs by the presence of a thiophene instead of a benzene ring
- Also possesses an additional ester group which is rapidly hydrolyzed by blood/tissue esterases
- The thiophene nucleus imparts good lipid solubility
- Greater than lidocaine
- Less toxic than lidocaine
Rapid hydrolysis

Adverse reactions

- Blood

Hematologic effects

- Methemoglobinemia

Reported in some patients undergoing IVRA

No reported during dental anesthesia

Iv methylene blue (1 to 2 mg/kg)

- Cardiovascular

- Hypotension

- Arrhythmias (epinephrine)

- Adverse reactions

  - Central nervous system

Dizziness

Agitation

Nervousness

Anxiety

Headache disorientation

Tremors

Seizures

  - Inadvertent intravascular injection appears to account for many cases of CNS reactions.

  - Paresthesia

Loss of sensation

Burning

Tingling

  - High dental concentration

Gastrointestinal effects

  - Nausea and vomiting

Occurred occasionally

Ocular

  - Ophthalmic effects

Diplopia (intraoral)

Mydriasis

  - Few minutes of anesthetic block and persisted for an average of 50 minutes

Skin
- Dermatologic effects
  - Erythematous nonpruritic skin rashes IVRA

- Adverse effects
  - Hypersensitivity
  - Urticaria
  - Edema
  - Pruritus
  - Erythema
  - Teratogenicity
    - US Food and Drug Adm pregnancy category C (Prod Septocaine)

- Tumescent local anesthesia
  - 0.038% articaine
  - 1:1,000,000 epinephrine
  - 0.00095% trimacinolona
  - 0.08% NaHCO3

- 850 patients