UND Nurse Anesthesia Student Presentations

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North Dakota Association of Nurse Anesthetists
Bismarck, ND

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Propofol Administration in Patients with an Egg Allergy

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Introduction

- There has been a long-standing debate about whether propofol can be administered to patients with an egg allergy. Propofol warning labels in some countries list hypersensitivities to eggs as a contraindication to its use
- However, labels vary from country to country even when the same formulation is utilized
- Conflicting statements and inconclusive evidence has resulted in confusion

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Introduction

- There have been many case reports written about anaphylactic reactions to propofol, but the mechanism of action remains unclear.
- The case reports lack confirmatory evidence linking propofol administration in patients with an egg allergy to an adverse reaction.

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Case Information

- Wound Closure
- 29-year-old
- 22 Kilograms
- 119 centimeters
- Male
- ASA III

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Pre-operative Evaluation

- Past Medical History
  - anorchidism, moderate-persistent asthma, bronchopulmonary dysplasia, chromosomal abnormality, congenital lobular emphysema, proportional dwarfism, hypospadias, mild mental retardation, multiple congenital facial anomalies, and nephrolithiasis
- Surgical History
  - Tracheostomy, gastrostomy, external auditory canal reconstruction, orchiopexy, hernia repair, right testicle removal, gastric fundoplication, and dental surgery

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Pre-operative Evaluation

- Allergies
  - Milk protein, latex, egg white, egg yolk, erythromycin, rocephin, and sulfamethoxazole/trimethoprim
- Current Medications
  - Mometasone furoate, cholecalciferol, budesonide, ipratropium-albuterol, benefiber, epinephrine as needed (PRN), carbamide peroxide 6.5% PRN, docusate sodium PRN, and guaifenesin PRN

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Pre-operative Evaluation

- Airway evaluation
  - Mallampati class II, a thyromental distance of fewer than three fingerbreadths, mouth opening of greater than three fingerbreadths, limited neck range of motion, a receding chin, and micrognathia
  - Previous tracheostomy site
    - Found to be nonpatent

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Pre-operative Evaluation

- Pre-op Vital Signs
  - Blood pressure 120/67 mmHg
  - Heart rate 86/min
  - Respiratory rate 20/min
  - Temperature 36.4 degrees Celsius
  - Oxygen saturation (SpO2) of 96% on room
- Regular heart rate and rhythm; bilateral clear lung sounds

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Anesthetic Course

- Drugs
  - ***Propofol 90 mg IV given in divided doses***
  - Fentanyl 75 mcg IV given in divided doses
  - Decadron 4 mg IV
  - Zofran 3 mg IV
  - Phenylephrine 125 mcg IV given in divided doses
  - Vancomycin 350 mg IV
- Airway
  - Size 2.5 LMA inserted
    - Adequate ventilation throughout short procedure

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Intraoperative Issues/PACU

- Intraoperative Issues
  - Mild Hypotension
- PACU
  - Time in the PACU was uneventful
  - No signs of an allergic reaction throughout his perioperative experience
  - Discharged home from phase II without incident

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Propofol Administration in Patients with an Egg Allergy:

Review of Literature

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Discussion

- To evaluate the research on propofol administration in patients with an egg allergy effectively, it is best first to know and understand the pathophysiology of allergic reactions and specifically egg allergies.
- The literature on these topics will be discussed first followed by a discussion regarding the administration of propofol in adults and children with a documented egg allergy.

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Anaphylactic/Anaphylactoid Reaction

- An anaphylactic reaction refers to a severe, life-threatening, rapidly developing, type I hypersensitivity (occurs rarely in anesthesia)
- Occurs due to an antigen-antibody interaction in a patient exposed to the antigen in the past and has become sensitized.
- Reactions are IgE-mediated
  - IgE antibodies found on mast cells and basophils react with an antigen causing the release of mediators

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Anaphylactic/Anaphylactoid Reaction

- The release of mediators cause the symptoms of an allergic reaction which may include anaphylaxis
- Symptoms are systemic and occur rapidly
  - Pruritus, urticaria, angioedema, laryngeal edema, hypotension, wheezing, bronchospasm, arrhythmias
- Anaphylactoid reactions may also cause mediator release, but are not triggered by an IgE-mediated reaction and symptoms are usually less severe

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Anaphylactic/Anaphylactoid Reaction

- Neuromuscular blocking agents top the list of medications that cause anaphylactic reactions (~50-70% of all reported cases)
- Anaphylactic reactions to propofol administration have been infrequently reported and the cause undetermined

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Egg Allergies

- Eggs are one of the most common causes of food allergies in children and the mechanism has been most often linked to an IgE-mediated, type I hypersensitivity reaction
- Usually exhibited before 2 years old (first dietary exposure)
- ~50% reach tolerance by 4 years old
- ~66-74% reach tolerance by 5 years old

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Egg Allergies

- 75% of children who are allergic to eggs tolerate egg yolk without incidence
- Both the egg white and egg yolk can cause an allergic sensitization, but only the egg white has been found to cause an allergic response
- Up to 90% of reactions to eggs affect the skin, followed by the GI system, and less frequently the respiratory system

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Egg Allergies

- Ovomucoid, found in egg white, is the leading egg allergen and is the most common cause of persistent egg allergy in children
- Only two of the nine proteins found in egg yolk are thought to be allergenic, which does not include egg lecithin (the component used in propofol)

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Propofol and Allergies

- Propofol is a lipid emulsion formulation and an alkylphenol derivative (2,6-di-isopropyl-phenol) that contains 100 mg/ml of soybean oil, 12 mg/ml of egg lecithin, sodium hydroxide, phosphatides, and glycerol
- Specifically designed with allergies in mind
- The egg lecithin, a highly purified phosphatide, found in propofol comes from egg yolk, but egg white contains the most allergy containing proteins

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Propofol and Allergies

- Case reports of allergic reactions to propofol have been described
  - The cause has either been undetermined or attributed to the di-isopropyl side chain (on first exposure) or the phenol group (after repeated exposure) rather than an egg allergy
- In all the case reports that were reviewed in which patients had an allergic reaction to propofol, none of the patients had allergies to egg

(Inal, Memis, Vatan, Cakir, & Yildiz, 2008; Koul et al., 2011)

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Propofol and Allergies

- Nishiyama (2013)
  - A randomized controlled trial was completed to determine the safety of using propofol in patients with allergic diseases and/or bronchial asthma
  - Incidence of wheezing and bronchoconstriction after propofol administration was higher in this patient population than in patients without allergic disease or bronchial asthma
  - All patients with egg allergies were excluded from this study, yet severe reactions still occurred

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Propofol and Egg Allergies

- Asserhoj, Mosbech, Kroigaard, and Garvey (2016)
  - A retrospective study was completed to determine if avoiding propofol in patients with egg, soy, or peanut allergies is evidence-based
  - The first cohort included patients who had a peri-operative allergic reaction and were exposed to propofol and the second included patients who had an IgE-mediated egg, soy, or peanut allergy and received propofol
  - In the first cohort 4 patients had positive allergy tests to propofol. Only 1 patient showed a possible IgE-mediated allergic reaction to propofol, yet did not have an egg, soy or peanut allergy
  - Patients in the second cohort who had IgE-mediated egg, soy, or peanut allergies had no allergic reaction when given propofol

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Propofol and Egg Allergies

- Molina-Infante et al. (2014)
  - A retrospective observational study was conducted to assess the safety of propofol administration in patients with both eosinophilic esophagitis (EoE) and an egg, soy, legume, or peanut allergy
  - Patients had either and allergy or a sensitization to one of these foods
  - No allergic reactions were reported in any of the cases in which patients received propofol. Some of the patients in this study received propofol for the first time while the others had received propofol multiple times before

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Propofol and Egg Allergies

Pediatric Population

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Propofol and Egg Allergies

- Wiskin, Smith, Wan, Nally, and Shah (2015)
  - A retrospective analysis was completed to determine if propofol administration in children with either non-IgE or IgE-mediated eggs, soy, or nut allergies is safe. No undesirable events that occurred were accredited to propofol.
  - It was concluded that it is likely safe to administer propofol to children with egg or soy allergies

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Propofol and Egg Allergies

- Murphy, Campbell, Baines, and Mehr (2011)
  - A retrospective case review regarding the safety of propofol administration was completed on a sample of children with IgE-mediated allergies to egg or soy. All but one child received propofol with no issue, including a child with a severe history of egg anaphylaxis
  - Another child with a history of egg anaphylaxis developed a nonanaphylactic reaction after receiving propofol for the first time→ Cause undetermined
  - Concluded that propofol can be safely administered in most pediatric patients with egg allergies, but should be avoided in children with a history of anaphylaxis to egg

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Recommendations

- Although it is certain that propofol can cause an anaphylactic or anaphylactoid reaction, the cause of these reactions is inconclusive, but decidedly unrelated to egg allergies in the adult population
- Research also shows that children with moderate egg allergies can be safely given propofol, but more research needs to be done before conclusions can be undoubtedly made on the use of propofol in the pediatric patient with a prior anaphylactic reaction to eggs

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Conclusion

- Most individuals with egg allergies are allergic to egg whites, but the egg lecithin found in propofol is derived from egg yolk. The egg lecithin is thought to be very unlikely to cause an allergic reaction in patients with an egg yolk allergy because it is highly refined and contains minimal egg yolk protein
- The patient described in the initial case report was allergic to both egg white and egg yolk, yet he did not have an allergic reaction when given propofol. The case report described coincides with the current research that states patients with an egg allergy can safely be given propofol.

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The Effectiveness of Dexmedetomidine in Patients Receiving Spinal Anesthesia

Eric Heiden, SRNA

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Introduction

- Spinal anesthesia is a common anesthesia technique used with reliable results within the operating room.
  - A failed subarachnoid block due to prolonged surgical duration can be difficult and frustrating issue for anesthesia providers.
  - The overall failure rate for Subarachnoid blocks has been reported to be 0.6%, with about one-fourth of all failed SABs attributed to prolonged surgical times.
  - One disadvantage of a SAB is the inability to extend the duration of the anesthetic intraoperatively due to the needs of a prolonged surgical procedure

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Case Information

- Right Total Hip Arthroplasty
- 64 year old
- Weight – 90 kg
- Gender - Male
- ASA 2
- No known allergies

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Pre-operative Evaluation

- Medical History
  - Gastroesophageal reflux, insomnia
- Surgical History
  - Tonsillectomy as a young child
- Pre-op VS
  - BP 136/84, HR 84, RR 16 , SpO2 98%
- Airway evaluation
  - Mallampati II, TMD > 3 fingerbreadths, full neck range of motion, intact dentition

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Anesthetic Course

- Preoperative sedation
  - 100 mcg Fentanyl
  - 2 mg Versed
- Technique
  - Spinal anesthesia with 22g Pencan Needle
  - 1.7 ml Bupivacaine 0.75%
  - 0.2 mg Morphine
- EtCO2 NC with O2 @ 2 LPM
- Maintenance
  - Dexmedetomidine bolus 0.5 mcg/kg over 10 minutes followed by maintenance at 0.5 mcg/kg/hr
  - Tranexamic Acid 1 gm
  - Ondansetron 4 mg

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Intraoperative Issues

- Total Anesthesia Time
  - 3 hrs 20 min
- Estimated Blood Loss
  - 500 ml
- Complications
  - Airway obstruction (improved with positioning and chose dexmedetomidine over propofol for sedation)
  - Bradycardia (glycopyrrolate 0.2 mg)

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Postoperative

- Dexmedetomidine discontinued at incision closure.
- Patient following commands and denied pain in PACU.
- Vital signs within normal limits.

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Spinal Anesthesia

- Premedication for the spinal procedure is at the discretion of the anesthetist and is most often dependent on comorbidities and anxiety level of the patient.
- Local anesthetic and addition of opioid are chosen based on the length of surgery and surgical procedure.
- The exact mechanism of action for subarachnoid anesthesia continues to contain much speculation.

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Spinal Anesthesia

- The primary site of action for the blockade is the nerve roots within the spinal cord.
- The spread of local anesthetic is based on the positioning of the patient, physical/chemical properties of the drug, and characteristics of the space in which it is to spread.
- When drug concentrations reach a minimally effective concentration at the nerve root, neuronal transmission is altered in a clinically significant way, which provides anesthesia

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Spinal Anesthesia

- Blockade of neural transmission in the posterior nerve root fibers interrupts somatic and visceral sensation, whereas blockade of anterior nerve root fibers interrupts efferent motor and autonomic outflow. (Nagelhout & Plaus, 2013)

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Dexmedetomidine

- A selective alpha-2 adrenergic agonist that functions by stimulating the receptors, resulting in a decrease of catecholamine release and sympathetic nervous system (SNS) response.
- Dexmedetomidine's primary effects are sedation with minimal respiration depression, anxiolysis, reduced postoperative shivering and agitation, and cardiovascular sympatholytic actions.

(Eilers & Yost, 2015; Nagelhout & Plaus,)

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Dexmedetomidine and Spinal Anesthesia

- The highly selective alpha-2 agonist with spinal anti-nociceptive (visceral and somatic) properties produces a synergistic effect with intraspinal local anesthetics. (Kalso, Pöyhiä, & Rosenburg, 1991).
- The reduced noradrenergic outflow is thought to strengthen the inhibitory nociceptive effect on the spinal cord. (Samuels & Szabadi 2008).
- The higher alpha-2 receptor selectivity for IV dexmedetomidine reduces the severity of hemodynamic instability (bradycardia and hypotension) and is capable of extending the duration of a SAB longer than clonidine. (Abdallah, Abrishami, & Brull, 2013)

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Dexmedetomidine

- Dosage
  - Standard adult dosing is 0.5-1 mcg/kg IV bolus infused over 10 minutes followed by a maintenance infusion of 0.2-0.7 mcg/kg/hr.
- Side Effects
  - Dexmedetomidine has been shown to exhibit moderate decreases in heart rate and systemic vascular resistance, which leads to a decrease in systemic blood pressure.
  - A bolus injection may produce a transient increase in systemic blood pressure and pronounced decrease in heart rate.
  - Bradycardia associated with dexmedetomidine infusion may require treatment.
  - Heart block, severe bradycardia, and asystole have been observed and may result from unopposed vagal stimulation

(Nagelhout & Plaus, 2013)

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Dexmedetomidine and Spinals

- A supraspinal mechanism of action of IV dexmedetomidine has not been clearly defined.
- It is thought that when administered IV alpha-2 agonists inhibit the activity of the locus coeruleus in the brain, leading to noradrenergic nuclei (Johnson & Pugh, 2016).
- The decreased noradrenergic outflow is believed to strengthen the inhibitory nociceptive effect on the spinal cord (Samuels & Szabadi 2008).

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Studies

- A significant disadvantage of subarachnoid anesthesia is the inability to extend the duration of the anesthetic intraoperatively to address the needs of prolonged surgical procedures.
- The results of the Abdallah et al. (2013) review suggests that IV dexmedetomidine in conjunction with spinal anesthesia can prolong the duration of sensory block and to a lesser extent motor block. It was also found that IV dexmedetomidine might delay the time to first analgesic request after spinal anesthesia.

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Studies

- In 2016, the American Association of Nurse Anesthetists (AANA) Journal conducted and published an evidence-based review, which updates the Abdallah et al. 2013 systematic review.
- The impact was determined to be that IV dexmedetomidine prolonged the maximal duration with little effect on the initial level of sensory blockade.

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Discussion

- There are several methods available as adjuncts to standard one shot spinal alone that include using intrathecal adjuncts, combined spinal-epidural techniques, and higher subarachnoid local anesthetic doses. Intravenous dexmedetomidine offers a simple, effective method for prolonging the duration of motor and sensory blockade and postoperative analgesia with a minimal side effect profile

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Recommendations

- If procedure is thought to be long, consider using dexmedetomidine IV infusion.
- Bolus dose isn't necessary, but 0.5 mcg/kg/min is recommended over 1 mcg/kg/min.
- Maintenance infusion at 0.5 mcg/kg/min.
- Study of cost analysis of propofol vs dexmedetomidine.
- Better comparison of local anesthetics.

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Conclusion

- Prolonged surgical duration is difficult to address with spinal anesthesia.
- Intravenous dexmedetomidine offers a simple, effective method for sedation, prolonging the duration of motor and sensory blockade and postoperative analgesia with a minimal side effect profile.

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Effects of Steep Trendelenburg Positioning on Intraocular Pressure

Grace Hauschild, SRNA

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Introduction

- Robot assisted procedures (RAP) are on the rise within medicine.
  - 1.5 million cases were performed in 2013 alone (Lee, 2014).
- RAP tout numerous benefits including shorter hospital stays, less blood loss, as well as a decreased recovery time (Gainsburg, Wax, Reich, Carlucci, & Samadi, 2010).
- RAP also carry risks associated with the required steep Trendelenburg (ST) positioning and a pneumoperitoneum
  - Compromising positioning places undo physiologic stress and leads to an elevated intraocular pressure (IOP).
  - Increased IOP places the patient at increased risk for postoperative vision loss (POVL) (Taketani, et al., 2015).

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Case Information

- Surgical Procedures: Da Vinci laparoscopic radical prostatectomy with pelvic lymph node biopsy
- 59-year-old Male
- 173cm and 105kg
- ASA 3
- **Allergies**: No known drug allergies
- **Home Medications**: Fish oil supplement, Claritin, ibuprofen, multivitamin.

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Pre-operative Evaluation

- **Past Medical History**: Allergic dermatitis, hyperlipidemia, paroxysmal atrial fibrillation, inguinal hernia, prostatitis, verruca vulgaris, obstructive sleep apnea with CPAP, and former smoker (Quit 1990)
- **Surgical History**: Knee arthroplasty with meniscectomy, inguinal hernia repair, colon surgery, colonoscopy, cardiac ablation.
- **Pre-op VS**: BP – 142/88 HR – 81 RR – 16 T – 36.9 SpO2 – 96%
- **Pertinent labs**: Hgb 15.7 g/dL Hct 44.4%
- **Airway evaluation**: Mallampati III, TM distance 2 FB, reduced TH distance, mouth opening >3 FB, thick neck with FROM

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Anesthetic Course

- **Induction**
  - Preoperative Midazolam 2mg
  - Preoxygenated via 100% face mask for five minutes
  - Induction with fentanyl 200mcg, rocuronium 5mg, lidocaine 40mg, propofol 200mg, and rocuronium 45mg IV.
  - Intubation with miller 2 blade obtaining a grade II view. A 8.0mm cuffed ETT was placed successfully and confirmed with EtCO2 and bilateral breath sounds.
- **Maintenance**
  - Dexmetetomidine infusion 0.3mcg/kg/hr
  - Desflurane 5% inspired concentration
  - Additional Medications: Rocuronium 100mg, decadron 10mg, dilaudid 1mg, ondansetron 4mg, neosynephrine 450mcg.

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Intraoperative Issues

- After 3 hours spent in ST position for the RAP, it was determined the patient's prostate was too large to continue minimally invasive resection.
- The robot was undocked and the procedure was converted to an open radical prostatectomy which lasted an additional 3 hours in the supine position.

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Intraoperative Issues

- After converting open, the patient began losing significant amounts of blood
  - 4th hour EBL: 500 mL
  - 5th hour EBL: 700 mL
  - 6th hour EBL: 500 mL
- Estimated total blood loss was 1,700 mL.
- A repeat hgb was drawn during the 5th hour and resulted at 9.5 g/dL.
- The patient received a total of 1,000 mL of albumin, and 5,100 mL of Lactated Ringers.

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Intraoperative Issues

- At the conclusion of the procedure, the patient was noted to have significant scleral and facial edema.
- The neuromuscular blockade was reversed with glycopyrrolate 0.8 mg IV and neostigmine 5 mg IV. Once the patient returned to spontaneous respirations, a leak test was performed and was positive for an air leak.
- Once appropriate extubation criteria was met, the patient was extubated and placed on 2 L/min O2 NC.

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PACU

- In PACU, the patient began to describe painful eye irritation.
- Further evaluation by the anesthesia team was done to rule out a corneal abrasion
  - Prophylactic antibiotic eye drops were administered.
- The patient was instructed to stay in the upright position to promote facial edema drainage.
  - Within 24 hours, the scleral edema had subsided and the patient denied any further eye irritation.

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Physiology of Blood Flow in the Eye

- Perfusion to the optic nerve is determined by the ocular perfusion pressure (OPP).

  OPP = MAP – IOP
- An increase in IOP or a decrease in MAP will cause OPP to suffer
  - Compromised perfusion to the optic nerve.
- Ocular blood flow is also auto regulated and perfusion is best when IOP and MAP fluctuate.
  - There is a perfusion pressure range in which ocular autoregulation is effective.
  - General rule of thumb, IOP > 40mmHg or a low MAP will result in poor perfusion (Gilbert, 2008)

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Risk Factors for POVL

- **Patient Factors:**
  - BMI > 35 kg/m2
  - Age > 62 years old
  - Diabetes
  - Vascular Disease
  - Hypertension
  - Atherosclerosis
  - Glaucoma
  - Smoking History
  - (Molloy, Cong, & Watson, 2016)
- **Surgeries**
  - Cardiac Surgery (4.5% incidence)
  - Spinal Surgery (0.2% incidence)
- **Intraoperative Factors**
  - Increased CVP
  - Hypotension
  - Severe Hypertension
  - Acute Hemorrhage
  - Large fluid boluses
  - Positioning (Prone)
  - Pneumoperitoneum
  - (Gilbert, 2008)

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Pathophysiology of RAP and POVL

- True ST occurs when a head down tilt of 45 degrees is performed.
  - Effectively shifts blood flow to central compartment
  - Increases hydrostatic pressure, MAP, and CVP (Schramm, et al., 2013)
- Determinants of IOP are aqueous humor flow, choroidal blood volume, CVP, and extraocular muscle tone (Hoshikawa, et al, 2014).
  - ST and increased central compartment blood lead to increased congestion within the eye, decreased OPP, and increased IOP.

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Pathophysiology of RAP and POVL

- IOP increases of ≥ 35mmHg lead to "…incremental damage to the optic disc and retinal nerve fibers" (Raz, et al., 2015, p. 1218).
  - IOP ≥ 22 mmHg lead to ocular hypertension
- Pneumoperitoneum causes an increase in choroidal blood volume thus increasing IOP.
  - May be assessed utilizing ETCO2
  - High ETCO2 correlates with an increase in choroidal blood volume and IOP.
  - The increase may result in the most common type of POVL known as ischemic optic neuropathy (Yoo, et al., 2014).

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Pathophysiology of RAP and POVL

- Pneumoperitoneum continued...
  - The associated increase in IOP has been shown to be time dependent, and increases when ST is added (Yoo, et al, 2014)
  - According to Molloy (2011), a clinically significant reduction in OPP occurs after 120-160 minutes in ST.
    - After 160-170 minutes in ST, ocular autoregulation has been found to suffer
    - Increases the risk for periorbital and conjunctival edema and POVL.

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Evaluation of Intraocular Pressure

- In 2012, Molloy proposed a visual assessment for anesthetists to perform quick evaluations of IOP.
  - Eyelid edema alone is a reliable sign of increasing IOP.
  - If conjunctival edema (chemosis) is present, it is a reliable sign of an IOP > 40mmHg.
    - Critical range and intervention is recommended by opthalmologists.

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Proposed Preventative Measures

- **Dexmedetomidine Infusion (Kim, et al., 2015)**
  - Potent selective α2-adrenergic agonist
    - Analgesic, sedative, sympatholytic and hypnotic effects without significant respiratory depression.
  - Exact mechanism for impact on IOP is unclear.
  - Proposed mechanism is the "…direct vasoconstriction in afferent blood vessels of the ciliary body [results] in decreased aqueous humor production, which may affect the decrease in IOP" (p.315).
  - Infusion rate of 0.4mcg/kg/hr without a loading dose was utilized.
  - Between the control and experimental group, significant reductions in IOP were seen in the experimental group.

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Proposed Preventative Measures

- **Propofol Based TIVA (Yoo, et al., 2014)**
  - Study compared a sevoflurane based anesthetic to a propofol based TIVA anesthetic.
  - Propofol was shown to be superior in attenuating IOP increases in addition to providing a higher OPP.
    - Result supported by Schafer and colleagues, whom also found a lower IOP in patients when a propofol based TIVA was used (2002).
  - Further research is needed to determine if this finding is generalizable, and will reduce incidence of POVL.

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Proposed Preventative Measures

- **Modified Z Positioning (Raz, et al., 2015)**
  - Modified ST position: head and shoulders remain in a horizontal position while tilting the patient in ST position.
  - The modification reduced the rise in IOP
  - No compromise surgical exposure, robot docking, anesthetic, or the procedure with modification.
  - Patients displayed normal facial soft tissue post operatively
    - Those in ST displayed visible facial edema.
  - Limited study related to a small sample size and some limited IOP measurements

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Proposed Preventative Measures

- **Timolol Eye Drop Administration (Molloy & Cong, 2014)**
  - Dorzolamide (carbonic anhydrase II inhibitor) acts to decrease production of the aqueous humor and timolol (B2-adrenergic blocker) blocks beta receptors in ciliary body.
  - One drop of the solution was administered to an experimental group undergoing RAP in ST.
    - However, ALL patients received a drop of the solution if their IOP > 40 mmHg.
  - The experimental group had an average of 26% lower IOP than the control throughout the procedure.
  - Participants who received the drops experienced less periorbital edema.

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Recommendations

- Current literature has proposed multiple recommendations to attempt to reduce the incidence of POVL.
- However, it is unwise at this time to recommend a new standard or change to practice based on current evidence.
- Due to small sample sizes and many being the first studies of their kind, it must be concluded that these results are not yet generalizable to the broader patient population.

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Conclusion

- RAP are increasing in incidence and their role in surgical medicine is expanding.
  - As this surgical technique expands, anesthesia must adapt with it.
- While the outlined case study patient recovered without significant complications, his eye irritation may serve as a warning of the potential complications that may occur during RAP in ST.

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Thank You
Are There Any Questions?

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Anemia of Unknown Origin in an Otherwise Healthy ASA 1 Patient

Andrew Rook, SRNA

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Fluid Administration: A Historical Perspective

- 1739 William Hewson observed "Ruddy Gobules" under microscopic and due to the large number decided that they must be important
- 1852 Karl Vierordt found fewer RBCs in what was deemed an "Anemic" patient
- 1818 1st human to human blood transfusion
- 1884 saline infusions replaced milk as fluid of choice
- 1907 Ludvig Hektoen introduced the concept of cross-matching blood

(Urthma, 1998)

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Anemia Presentation

- HGB:
  - **< 12 in Women**
  - **< 13 in Men**
- Fatigue
- Pale skin
- Dizziness/feeling of faint
- Decreased LOC Cold hands/feet
- Chest pain

(Grossman & Porth, 2014)

- Dyspnea
- Unusual cravings such as dirt or ice
- Low 02 sats (<90%)
- Increase in HR
- Decrease in BP
- Pulsus paradoxus

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Prevalence of Anemia

- Age
  - 17-49- **Male**: 1.5% **Female**: 12.2%
  - 65-85- **Male**: 11% **Female**: 10.2%
  - > 85- **Male**: 26.1% **Female**: 20.1%
- Individuals presenting for colorectal surgery (39%-75%)
- Frailty- Nursing home patient carry a 40% rate
- Individuals from outside of North America and Europe

(Clevenger & Richards, 2015)

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Types of Anemia

- Iron Deficiency
  - Chronic blood loss through GI or inability to absorb iron
- Aplastic Anemia
  - Bone marrow stops producing RBCs along with WBCs and platelets
- Hemolytic Anemia
  - Wide range of acquire and inherited disorders
  - Characterized by premature destruction of RBCs, retention of iron, and increased erythropoiesis
  - Sickle cell disease and thalassemia

(Grossman & Porth, 2014)

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Types of Anemia

- Fanconi Anemia
  - Heterogenous recessive disorder
    - Hematologic abnormalities seen in most by age 7 with complete bone marrow failure by age 40.
- Pernicious Anemia
  - Body is unable to absorb vitamin B12
- Acute blood loss
- Anemia of Chronic disease
  - CKD

(Grossman & Porth, 2014)

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Case Information

- Surgical Procedure
  - Elective facial osteotomy
- Pertinent Patient Information
  - 18-year old, male
    - Athlete with no physical limitations
  - 75 kg 73in
  - ASA 1
  - Seasonal Allergies

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Pre-operative Evaluation

- No pertinent medical/surgical HX
- Pre-op VS
  - BP: 133/67, HR: 57, RR 18, 02 Sat: 99% on RA, and temp. 36.5C
- Pertinent labs
  - Hgb: **8.0 g/dl**
  - Hct: **31%**
  - Plts 481 K/uL
- Airway evaluation
  - Mallampati II, recessed mandible, and full ROM

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Anesthetic Course

- Induction
  - Versed 2mg
  - Fentanyl 100mcg
  - Rocuronium 5mg
  - Propofol 150mg
  - Succinylcholine 200mg
- Technique
  - 7.0 ETT placed nasally, MAC 4, X2 attempts after neosynephrine spray administered
    - 50ml EBL
- Vent Settings
  - VC, RR 12, TV 600, PEEP 4cmH20, FIO2 40%
    - Maintenance
      - Desflurane 8%
      - Fentanyl 50-100mcg Prn
      - Dilaudid 1mg
      - Rocuronium Prn
      - Ofirmev 1G
    - Anti-emetics
      - Zofran 4mg
      - Decadron 8mg
    - Reversal
      - Neostigmine 4mg
      - Glyco 0.6mg

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Intraoperative issues

- After 750ml EBL, an H&H was performed
  - **Hgb 7.1g/dl & Hct 26.1%**
  - Vital signs stable
- I/O
  - EBL total: **1.25L**
  - 2.5L LR
  - 500 mLs 5% Albumin
  - 350 mLs UO
- Total Anesthesia Time
  - 3 hours 20 min

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PACU

- All vitals stable
- Awake extubation was completed with no issues
- Pain level 3/10
  - Additional Prn fentanyl ordered
- No PONV or intraoperative awareness reported
- Transferred to Med/Surg floor
  - Discharged the following day
  - **Repeat H&H revealed 6.7 g/dl and 26.4%**

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Preoperative Evaluation for Anemia

- CBC
  - Hemoglobin/Hematocrit
  - Differentiate etiology of anemia
  - Not recommended on healthy individuals presenting for elective surgery
- Age
- Medical history
  - Cancer
  - Kidney disease
  - Etc.
- Ethnic Background
- Surgery being performed

(Olson, Stone, & Lubarsky, 2005).

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Intraoperative Treatment Options

- Crystalloid
- Colloid
- Blood
- Preoperative management
  - Iron
  - B12
  - Folate
  - Erythropoietin

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Crystalloid Fluid

- LR & 0.9% Normal Saline
- 4-2-1 rule
- Replace blood loss 3:1
- Intravascular half life of 20-60minutes
- Only about 1/5 of the volume remains within the intravascular space
- Side effects:
  - Hyperchloremic metabolic acidosis
  - Hemodilution
    - 1% decrease in Hgb and Hct per 160ml of fluid
- *Does not help oxygen carrying capacity*

(Lahasaee, Ghaffaripour & Heir, 2013)

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Colloid Fluid

- High molecular weight substance
- Replace blood loss 1:1 ratio
- Can increase IV volume by as much as 5X the volume given
- IV ½ life of 3-6 hours
- Natural
  - Albumin- More expensive, small risk of disease transmission
  - Smaller side effect profile when compared to other colloids
- Artificial
  - Much cheaper
  - Larger side effect profile- reduce coags, renal impairment, & anaphylactoid reactions
- *Does not replace oxygen carrying capacity*

(Mitra & Purva, 2009)

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Blood

- Replace blood loss 1:1 ratio
- PRBCs should increase Hgb by 1g/dl and Hct 3%
- Side effects can occur in up to 59% of transfusions
  - SE include: fever, chills, tachycardia, dyspnea, N/V, bronchospasm, shock, pulmonary edema, and CHF
  - Only a documented rate of about 5%
  - TRALI carries largest mortality rate- Non-cardiogenic pulmonary edema
  - Massive transfusions can lead to citrate toxicity and hyperkalemia

(Carson et al., 2016)

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Transfusion Triggers

- **Restrictive**- Hgb 7-8g/dl
- **Liberal**- Hgb 9-10g/dl
- Allowable blood loss
  - More blood loss predicted
- Past medical history
- Surgery being performed
- Vital signs

(Grossman & Porth, 2014)

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Transfusion Triggers

- AABB looked at 31 RCTs (12,587 participants)
- Found no increase in adverse clinical outcomes (Restrictive)
  - (30 day M&M, strokes, rebleeding, or MI)
- Actually showed slightly better outcomes when transfusion reactions were included

(Carson et al., 2016)

- Retrospective study looking at 14,000 ASA 1-2 patients for elective surgery
- 0.8% had starting Hgb <9g/dl
  - All had preexisting conditions
- Only four required blood transfusions
  - Again, all had preexisting conditions

(Olson, Stone, & Lubarsky, 2005)

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Transfusion Triggers

- Carson and Patel (2014) looked at a small group that refused/were unable to receive blood products
- Significant increase in M&M wasn't observed until Hgb levels dropped below 5g/dl
- Showed that triggers points could eventually be lower

(Carson & Patel, 2014)

- Another study conducted by Carson et al. demonstrated no increase in 30 day M&M when a restrictive transfusion protocol was used
- Decrease in hospital length
- Increase in patient satisfaction
- Decreased transfusion reactions by 43%

(Carson et al., 2016)

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Preoperative Management

- Iron supplementation- ferrous sulfate/IV iron
  - Iron deficiency anemia
- B12 for folate deficiency
- Erythropoietin
  - May be needed for any type of bone marrow suppression
- Cancel procedure if Patient is not optimized
  - Not always an option

(Patel & Carson, 2009)

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Conclusion

- Restrictive transfusion protocol (7-8g/dl) has a less adverse effects then a more liberal protocol
- Blood loss can be effectively managed through other fluids
- Routine labs do not need to be drawn on healthy individuals presenting for elective cases
- If labs not optimized prior to elective case- Cancel case and reassess the patient

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Thank You
Are There Any Questions?

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Apneic Oxygenation

Scott Honkola, SRNA

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Oxygen

- According to an American Association of Nurse Anesthetists (AANA) closed claims study, the most common negative outcome was due to a respiratory event, accounting for 31.8% of all claims from 2003-2012
- Oxygen desaturation (<90%) can occur in as little as 45 seconds following the onset of apnea if the anesthesia provider is unable to successfully ventilate or intubate the patient

Jordan & Quraishi, 2015

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Oxygen

- The normal oxygen demand is 200-250 mL/minute; effective preoxygenation can allow a healthy patient to have an oxygen reserve of 5-8 minutes
- Adequate preoxygenation allows a buffer period during periods of apnea and hypoventilation and prolongs the duration of safe apnea, which is defined as the time until a patient reaches a SpO2 of 88% to 90%
- According to the steep portion of the oxyhemoglobin dissociation curve, once a patient's SpO2 reaches this level they can decrease to critical levels of SpO2, less than 70%, very rapidly

Butterworth, Mackey, & Wasnick, 2013, Weingart & Levitan, 2012

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Review of Literature

- A review of literature was conducted using the Harley E. French Library to determine current recommendations on the following topic:
- Anesthesia providers clearly understand the importance of preoxygenation prior to the induction sequence while the patient is awake and spontaneously breathing, however providers may not understand the **role of apneic oxygenation** in this process.
- Can **apneic oxygenation** allow the anesthesia provider a longer safe apneic period while attempting to secure an airway?

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Case Information

- Surgical Procedure: Bronchoscopy, thoracoscopy, and left lower lobectomy with mediastinal lymph node biopsy
- Age: 59-year old
- Weight/Height/BMI: 98 kg, 180 cm, 30.2 kg/m^2
- Gender: Male
- Allergies: Succinylcholine (pseudocholinesterase deficiency)
- ASA: 3

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Pre-operative Evaluation

- Past Medical History: Degenerative disk disease, lumbar spondylosis, anxiety, depression, GERD, lung cancer, prolonged paralysis following succinylcholine
- Surgical History: Bronchoscopy, mediastinoscopy, back surgery, shoulder arthroscopy, and tonsillectomy
- Home Medications: Lorazapam, naproxen, omeprazole, and zolpidem.
- Pre-op VS: BP 143/96, HR 80, RR18, SpO2 96%
- Airway Evaluation: M II, TM distance >3 FB, mouth opening >3 FB, full neck ROM, and chipped/capped teeth

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Pre-operative Evaluation

- Laboratory Data:
  - Na 140 mEq/L
  - K 3.9 mEq/L
  - Glucose 101 mg/dL
  - Cl 110 mmol/L
  - Ca 8.5 mg/dL
  - Mg 2.4 mEq/L
  - Creatinine 0.8 mg/dL
  - BUN 12 mg/dL
  - pH 7.41
  - pCO2 36
  - HCO3 26
  - Hgb 16.3 g/dL
  - Hct 47%
  - Plts 188

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Pre-operative

- Nasal cannula at 5 L/min started in pre-op and remained in place until ETT placement confirmed in OR

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Anesthetic Course

- GETA:
  - Midazolam 2 mg
  - Fentanyl 150 mcg
  - Lidocaine 50 mg
  - Propofol 200 mg
  - Cisatracurium 10 mg
  - 39 French left DL ETT via Mac 4 blade
  - Sevoflurane 2 – 2.5%
  - Arterial line
- Additional Medications:
  - Ancef 2 g
  - Fentanyl
  - Cisatracurium
  - Phenylephrine
  - Ondansetron 4 mg
  - Dexamethasone 8 mg
  - Glycopyrrolate 0.6 mg
  - Neostigmine 4 mg

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Intraoperative Issues

- Tachycardia – IV fluids and prn fentanyl
- Hypotension – IV fluids and prn phenylephrine (50 – 100 mcg)
- Decreased SpO2 – 100 % O2 (SpO2 increased to low/mid 90s)

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Postoperative

- Uneventful awake extubation
- Transferred to PACU with non-rebreather mask 10 L/min
- Alert and oriented, tolerable pain level of 2/10 in PACU
- Transferred to med/surg floor
- Discharged home on post-operative day 3

- Case Totals:
  - Urine output 450 mL
  - EBL: 100 mL
  - LR: 1,900 mL
  - Case duration: 2.3 hours

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Physiology of Oxygenation

- O2 is transported in the blood and carried in two forms: dissolved and bound to hemoglobin
- Majority of O2 (approximately 98%) is bound to hemoglobin, while the other 2% is transported in the dissolved state
- Only O2 that is in the dissolved state is able to transfer across the cell membrane, produce a partial pressure (PO2), and make itself readily available for use in cell metabolism

Grossman & Porth, 2014

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Physiology of Oxygenation

- O2 moves from the air in the alveoli, which is rich in O2 and low in CO2, to the blood in the pulmonary capillaries
- Adequate circulation of blood through the pulmonary blood vessels (perfusion) and appropriate contact between ventilated alveoli and perfused capillaries (ventilation and perfusion matching) are also important for adequate oxygenation of the blood and removal of CO2
- Adequate preoxygenation increases the O2 content and eliminates much of the nitrogen (denitrogenation) from the FRC and can allow O2 to be delivered to the blood for up to 12 minutes in a healthy individual

Nagelhout & Plaus, 2014, Grossman & Porth, 2014

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Physiology of Oxygenation

- The concept of preoxygenation has been around since the 1950s
- O2 consumption in an adult patient at rest with an ideal body weight is roughly 200 – 250 mL/min
- O2 stored in the lungs and blood is readily mobilized, and these reserves are quickly used up during periods of apnea
- The typical O2 reserve for a healthy individual breathing room air ranges from 1.0-1.5 L
- This amount increases to approximately 3.5 – 4 L in an individual that has been optimally preoxygenated with 100% O2

Tanoubi et al., 2009, Weingart & Levitan, 2012

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Physiology of Oxygenation

- Since Hgb is almost 100% saturated when a person is breathing room air, preoxygenating with 100% O2 will only slightly increase the blood O2 content
- Any additional O2 that is given prior to the apneic period is stored in the lungs and allows for a longer period of safe apneic time because it is used instead of the hemoglobin-bound O2

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Apneic Oxygenation

- Apneic oxygenation (AO) is a concept that has been described in medical literature for more than a century
- O2 continues to be taken from the lungs into the blood during periods of apnea
- This uptake of O2 is greater than the return of CO2 from the blood to the alveoli, which causes a net loss of volume in the lungs and results in a negative pressure space within the lungs
- Because of the negative pressure in the lungs, gas continues to be pulled from the upper airway into the alveoli, even without respiratory effort, as long as the airway remains patent

Biffen & Hughes, 2013

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Apneic Oxygenation

- If the gas being drawn into the lungs is mainly O2, it provides a reserve for the body and prolongs the period of apnea without desaturation
- The delivery of O2 for AO can be performed in a variety of techniques:
  - Nasal cannula
  - Nasopharyngeal catheter
  - Nasal prongs
  - Intratracheal catheter

Tanoubi et al., 2009

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Apneic Oxygenation

- A study performed by Taha and colleagues evaluated the effectiveness of nasopharyngeal oxygen insufflation following preoxygenation using the 4 deep breath technique within 30 seconds and the time to desaturation following the onset of apnea
- This study consisted of 30 ASA I or II patients scheduled for elective surgery requiring general endotracheal anesthesia
- Study group (n=15) received AO via nasopharyngeal catheter at 5 L/min
- Control group (n=15) did not receive AO
- In the control group, SpO2 fell to $\leq$95% at a mean time of 3.65 minutes
- In the study group, SpO2 was maintained in all patients at 100% until the cutoff time of 6 minutes was reached

Taha et al., 2006

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AO in Obese Patients

- Obese patients are likely to desaturate more rapidly during apneic periods due to their decreased FRC
- Baraka and associates study showed that patients who received nasopharyngeal O2 supplementation following preoxygenation had a significantly prolonged time to desaturation following apnea when compared to patients who received preoxygenation alone
- This study consisted of 34 patients with a body mass index (BMI) above 35 kg/m^2
- Study group (n=17) that received AO and preoxygenation: SpO2 remained at 100% until cutoff time of 4 minutes in 16 of 17 patients
  - Pt that desaturated to <95% had BMI of 65 kg/m^2 and was able to maintain apnea for 153 seconds
- Control group (n=17) that received only preoxygenation: SpO2 dropped to $\leq$95% in average of 145 seconds.

Baraka et al., 2007

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AO in Obese Patients

- Study by Ramachandran and colleagues involved 30 obese men undergoing general anesthesia
- Both groups had an average BMI of 31.2 kg/m^2
- Both groups received standard preoxygenation with a tightly sealed mask, breathing 100% O2 at 12 to 15 L/min until their end-tidal O2 was >90%
- Study group (n=15) received AO via nasal prongs at 5 L/min
- Control group (n=15) did not receive AO
- Study group had a significantly longer period of SpO2 remaining >95% (5.29 minutes) when compared to the control group (3.49 minutes)
- Also, 8 of the subjects in the study group still had a SpO2 >95% at 6 minutes, compared to only 1 in the control group

Ramachandran et al., 2010

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Nasal Prongs vs Nasopharyngeal Catheter

- Achar and colleagues study: Determine the effectiveness of administration of O2 through nasal prongs (NP) and nasopharyngeal catheter (NC) and the duration of SpO2 ≥95%
- Consisted of 56 adult ASA I and II requiring GETA
- All patients were preoxygenated until a FeO2 of >90% was reached. Induction was then performed, the ability to mask ventilate was confirmed, followed by paralysis with rocuronium
- Half received AO via NP and half received AO via NC (both at 5 L/min)
- Apnea held until SpO2 dropped ≤95% or cutoff time of 10 min
- Results: 9 patients in NP group desaturated compared to none in NC group (P=0.001)

Achar et al., 2014

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Recommendations

- Multiple AO techniques are available, and all effectively prolong the safe apneic period
- Most of the studies include small samples and patient populations
- Most studies include low risk, ASA I or II patients
- Larger studies involving higher risk patients are needed
- Several studies suggest the use of AO given the benefits outweigh the risks

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Conclusion

- Additional large, randomized controlled studies involving higher risk patients are needed
- The research and literature reviewed provided significant results and showed that by utilizing AO it may be able to give the anesthesia provider valuable time while attempting to secure a patient's airway
- This may be even more beneficial in patients that are at an increased risk of rapid desaturation, such as obese and obstetric patients
- AO is easy to implement into practice and the benefits definitely outweigh the risks

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Thank You
Are There Any Questions?

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Gabapentin Administration in Patients Undergoing Surgical Procedures

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Pain Management and Surgery

- Adequate perioperative pain control has received much attention in recent years
- Acute pain following surgical procedures is undertreated
- Practice guidelines for the management of acute pain were developed
  - acknowledgement of the inadequacies of perioperative pain control
  - the importance of adequate pain control
  - the need for providers to stay accountable for their patient's pain experience
- Providers now measured against national standards regarding perioperative pain management

(Miller et al., 2015)

History of Gabapentin

- Originally developed to imitate the structure of gamma-aminobutyric acid, a neurotransmitter
- First approved by the FDA for use as an adjunctive anticonvulsant medication, to be added to anti-seizure medication regimens in an effort to help control partial seizures
- Then, FDA approved gabapentin for the treatment of post-herpetic pain and other nerve related pain

(Sirven, 2010; Yan, Butler, Kurowski, & Perloff, 2014)

Review of Literature

- A review of literature was conducted, utilizing the Harley E. French Health Sciences Library to determine current recommendations regarding gabapentin use in the perioperative setting.

Case Information

- Surgical Procedure: elective left total knee arthroplasty
- Age: 75
- Weight: 107.6 kg
- Height: 180 cm
- Gender: Male
- Allergies: Lisinopril, Flonase, simvastatin, levoquin, levofloxacin, fluticasone propionate
- ASA: 3

Pre-operative Evaluation

- Past Medical History: type 2 DM, lung cancer, PVD, HTN, CAD, AS, hyperlipidemia
- Surgical History: AAA repair, thoracotomy, bilateral carotid endarterectomy, coronary artery bypass grafting, cardiac stent placement, and right total knee arthroplasty
- Home Medications: amlodipine, aspirin, clopidogrel, losartan, metformin, metoprolol succinate
- Pre-op VS: BP - 135/80, HR - 75, RR - 18, SpO2 - 97%, temp - 36.4 degrees C
- Airway evaluation: Mallampati 2, full neck ROM, large mouth opening, TM distance >3 FB, large neck circumference

Anesthetic Plan

- GETA chosen over a spinal
  - Patient had not withheld his clopidogrel
  - History of AS
  - No femoral block per surgeon preference
- Pre-operatively:
  - 600 mg gabapentin PO was administered 30 mins prior to procedure
  - 975 mg PO acetaminophen

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Anesthetic Course

- Induction:
  - 100 mcg Fentanyl
  - 150 mg Propofol
  - 50 mg Rocuronium
- Anesthesia maintained with sevoflurane 2%
- Tourniquet utilized for procedure; time = 82 mins
  - Blood loss less than 50 mL
- Maintenance phase unremarkable
- Emergence unremarkable
- 250 mcg more of Fentanyl given
- Other medications utilized for case:
  - 2 grams cefazolin
  - 15 mg ephedrine
  - 1200 mL LR

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Post-Op

- Immediate post-op period
  - 100 mcg Fentanyl in divided doses
- Quickly able to transition to oral Norco regimen
- 0.4 mg IV dilaudid given after 6 hrs of sleep without pain medication
- Patient reported pain was "very tolerable" throughout post-operative course

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Definition of Pain

- International Association for the Study of Pain (IASP) definition of pain –
  - "an unpleasant sensory and emotional experience associated with actual or potential tissue damage" (2012)

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Types of Pain

- Nociceptive – pain arising from stimulation of nerve cells
  - *Somatic*
    - identifiable localization
    - result of actual damage to tissue
    - sharp and stabbing nature
  - *Visceral*
    - more diffuse
    - dull or aching nature
- Non-nociceptive – messages of pain regardless of noxious stimuli
  - *Neuropathic*
    - results from a disorder of the CNS
    - burning or tingling in nature
  - *Idiopathic*
    - describes pain that has no apparent cause
    - often psychological symptoms present as well

(Nagelhout & Plaus, 2014)

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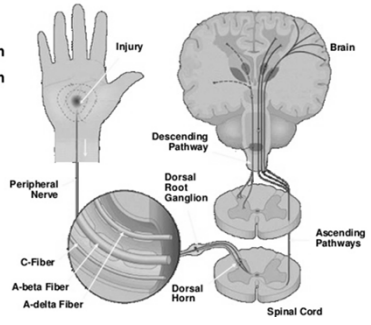
Physiology of Pain Perception

- **Transduction**
- **Transmission**
- **Modulation**
- **Perception**



(Wijatmiko, 2013)

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Pain and Surgery

- More than 80% of patients who undergo surgical procedures experience acute post-operative pain
  - 75% of these patients rating their pain as moderate, severe, or extreme
- Less than 50% of patients who undergo surgical procedures state their pain was adequately controlled post-operatively
- Inadequate post-operative pain control causes many well-documented adverse effects involving multiple organ systems

(Chou et al., 2016; Miller et al., 2015; Nagelhout et al., 2014)

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Multimodal Pain Management

- Utilization of medications and techniques with *varying mechanisms of action*, is more effective at relieving pain than single-modality interventions alone
  - Incorporates additive or synergistic effects of medications
- Multi-modal approach:
  - Decreases perioperative pain
  - Decreases medication side effects
  - Shortens recovery times
  - Helps institutions to increase patient satisfaction, while remaining economically sound

(Chou et al., 2016; Miller et al., 2015)

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Gabapentin

- Gabapentin [1-(aminomethyl) cyclohexane acetic acid] is a gamma-aminobutyric acid (GABA) – mimetic compound
  - GABA (with regard to pain modulation) is a neurotransmitter released via the descending pathway
  - While gabapentin is technically a synthesized form of GABA, it exerts no GABA agonist effects, nor does it inhibit GABA uptake or degradation

(Rose & Kam, 2002)

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Gabapentin MOA

- Gabapentin exerts its action by blocking voltage-gated calcium channels
  - It does this by binding to the alpha-2-delta subunits on the pre-synaptic side of the channel, reducing calcium influx
  - By blocking this influx, gabapentin produces a reduction in the release of pain-causing neurotransmitters from nociceptive afferents
- It is also hypothesized that gabapentin may exert analgesic effects by activating descending, inhibitory pain pathways

(Miller et al., 2015; Schmidt, Ruchelli, Mackey, Carroll, & Epi, 2013; Yan et al., 2014)

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Gabapentin

- The medication is only available in oral preparation
  - It is absorbed only in a relatively small part of the duodenum, through a process of diffusion and facilitated transport
  - The transport system is saturable
    - bioavailability varies inversely with its administration dose
    - As the dose is increased, a lesser percentage of the drug is actually available for absorption
- Peak plasma levels of the drug are achieved approx. 2-3 hours after ingestion, with peak cerebrospinal fluid levels occurring at 4-6 hrs after ingestion

(Khahi, Yaghooti, Marashi, & Nadjafi, 2011; Rose & Kam, 2002; Schmidt et al., 2013)

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Gabapentin

- Low side effect profile
- Most commonly reported side effects are somnolence/sedation and dizziness
  - Relatively rare reports of ataxia, headache, visual disturbances, convulsions, and peripheral edema
- If side effects occur, often just decreasing the dose will attenuate any adverse results

(Rose & Kam, 2002; Schmidt et al., 2013)

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Perioperative Gabapentin Use

- Can by employed in a large variety of surgical situations
  - In 2016, the Journal of Orthopaedic Surgery and Research found perioperative gabapentin dosing decreasing postoperative narcotic use and reduced pain scores in those who had received a total hip arthroplasty (Han, Li, Jiang, Ma, & Ma, 2016)
  - In 2014, it was found that preemptive administration of gabapentin was effective in decreasing postoperative pain scores, decreasing postoperative narcotic consumption, and decreasing PONV in those who had received an abdominal hysterectomy (Alayed, Alghanaim, Tan, & Tulandi, 2014)
  - In 2016, gabapentin was found to have significant beneficial effects on perioperative pain relief for those who have undergone HEENT surgeries, most prominent positive effects for those who had received rhinologic or thyroid surgeries (Sanders & Dawes, 2016)

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Gabapentin and Opioid Use

- Opioids have undesirable side effects such as nausea, respiratory depression, and sedation
  - They also have the increased potential for tolerance and addiction
- In 2016, Arumugam and colleagues completed a comprehensive literature search to study gabapentin and it's effect on postoperative opioid use
  - Included 17 randomized control trials, consisting of 1793 patients
- Concluded preoperative gabapentin administration did reduce opioid consumption in the first 24 hrs following surgery.
- Recommend clinicians utilize gabapentin in multimodal treatment plans

(Arumugam, Lau, & Chamberlain, 2016)

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Perioperative Dosing

- Optimal dosing of gabapentin and duration of its use is yet to be decided upon
  - Relatively few comprehensive studies to address this specific facet of administrations
- It is concluded that administration roughly two hours prior to surgery is desirable
  - Most completed studies on gabapentin do include preoperative doses
  - Though, preoperative, intraoperative, and postoperative initial dosing have all shown to reduce early postoperative pain
- Seems that postoperative doses of gabapentin should also be utilized following procedure

(Schmidt et al., 2013)

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Recommendations

- More research should be completed addressing optimal perioperative gabapentin dosing standards
- There is ample, recent evidence that indicates gabapentin is a useful tool for anesthetists

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Conclusion

- Perioperative gabapentin administration:
  - helps with post-operative pain
  - Boasts a low side effect profile
  - Allows less narcotic consumption
- Increasing importance placed on patient satisfaction
  - With adequate pain management, patient satisfaction scores can be expected to improve
  - Utilization of gabapentin in a multi-modal pain management plan can help this effort

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Thank You
Are There Any Questions?

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