

Understanding Intrathecal Duramorph Complications: Duramorph Hypothermia

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Abstract

A wide and diverse review of literature was conducted to research the phenomenon duramorph hypothermia that occurs after intrathecal preservative free morphine administration. This paper is to bring to light the harmful effects of duramorph hypothermia and what the anesthesia provider can do to eliminate these possible side effects. The adverse effects can cause immediate medical danger to the patient as well as increase their length of recovery. When there is a prolonged length of recovery there is also a delayed hospital discharge, further increasing medical costs. The average anesthesia provider may not have the knowledge base to develop a diagnosis, placing the patient at risk and delaying proper medical care as well. It is for this reason that providers need to have periodic continuing education presentations in order to bring awareness and increase anesthesia providers' knowledge of when to potentially expect the risk of duramorph hypothermia, how to recognize the symptoms, how to diagnose, and, ultimately, how to treat it. Hypothermia is normally a drop in temperature greater than 1°C from baseline or a core body temperatures between 34° C and 36° C from core body temperature readings. Low dose lorazepam of about 1mg IV push is the definitive treatment for the phenomena known as duramorph hypothermia.

Understanding Intrathecal Duramorph Complications: Duramorph Hypothermia

Problem

Intrathecal duramorph, also known as preservative free morphine, is not as benign of an intervention as most anesthesia providers previously assumed. Providers need to have a broad awareness of the different types of intrathecal anesthetic adjuncts available for treatment along with the potential side effects. The addition of duramorph to intrathecal anesthesia for obstetrics or orthopedic procedures has been associated with a delayed or misdiagnosed treatment plan for a phenomenon called duramorph hypothermia.

Duramorph hypothermia is not a benign perioperative side effect. The extended effects of hypothermia can cause some serious adverse effects to the patient. The adverse effects can cause immediate medical danger to the patient as well as increase their length of recovery. When there is a prolonged recovery phase there is also a delay in hospital discharge, further increasing medical cost.

The incidence of prolonged hypothermic events post intrathecal duramorph is not a common occurrence, but it is not quite rare either. The average anesthesia provider may not have the knowledge base to develop a diagnosis, placing the patient at risk and delaying proper medical care as well. It is for this reason that providers need to have periodic continuing education presentations in order to bring awareness and increase anesthesia providers understanding of when to potentially expect duramorph hypothermia, how to recognize the symptoms, how to diagnose, and, ultimately, how to treat it.

Review of Literature

Intrathecal duramorph has been known for its most common side effects including, sedation, nausea, respiratory depression, pruritus, vomiting, and urinary retention (Graham & Russel, 1997). This projects' purpose is to increase the anesthesia providers' understanding of a potentially misdiagnosed and improperly treated side effect the literature is calling duramorph hypothermia and its treatment plan. Commonly, with intrathecal anesthetic techniques, there is usually some degree of hypothermia due to the vasodilation effects seen with the use of local anesthetics, but not to the magnitude of duramorph hypothermia when used intrathecally. Consequently, most of the patients that experienced this form of hypothermia were medically treated improperly. The usual treatment for patients presenting with hypothermia is the use of forced air warming blankets, warmed intravenous crystalloid, and frequent bladder irrigation with warmed saline through a urinary catheter. In spite of all these attempts to warm patients with this form of hypothermia it was grossly ineffective. Additionally, many subjects presented with prolonged hypothermia that did not resolve with regression of the anesthetic accompanied with diaphoresis and the sensation of feeling hot, ironically, without shivering and failure of aggressive warming techniques (Ryan, Price, Warriner, & Choi, 2001).

Hypothermia is normally a drop in temperature greater than 1°C from baseline or a core body temperatures between 34° C and 36° C. Core body temperatures can be monitored from pulmonary artery catheters (PAC), esophageal temperature probes, temporal artery, and tympanic membrane thermometers (Ryan et al., 2001). The body controls its temperature from the hypothalamus, which receives sensory information from the skin surface, mainly, deep tissues, and the nervous system (Sayyid, Jabbour, Dima, & Baraka, 2003). Perioperative hypothermia occurs from either an increase in heat loss from the body's exposure to colder

surroundings also known as convection, or from abnormal thermoregulation mechanisms not fully understood in the brain and spinal cord (Ryan et al., 2001). Kurz et al., (1993) stated, “hypothalamic temperature seems relatively unimportant; instead, the regulatory system integrates thermal input from other parts of the brain, the spinal cord, deep abdominal and thoracic tissues, and the skin surface” (p.724). Contrarily, intrathecal morphine is linked to intensified hypothermic effects where epidural morphine had less of a central effect on thermoregulation, leading researchers to believe that the cephalic spread of duramorph intrathecally has a central effect on the hypothalamic centers of the brain (Hui et al., 2006).

Alterations to thermal regulation occur from the use of most anesthetic measures alone with regional anesthesia (Klekkas, Pouloupoulou, Papahatzi, & Souleles, 2005). Ultimately, “nerve blocks prevent regional manifestation of the major thermoregulatory defenses including sweating, vasoconstriction, and shivering” (Kurz, 2008, p.41). Regional anesthesia will first cause a drop in temperature of approximately 1-2°C from vasodilation caused from the sympathectomy, which normally has an effect for a duration of 60-90 minutes. The second effect noted for post-regional anesthesia is from impaired thermoregulation caudad of the sympathetic block (Sayyid et al., 2003). Additionally, thermoregulation is dependent on vasoconstriction, this is the body’s innate response to cold. Unfortunately, an altered or diminished response to vasoconstriction or shivering can alter the hypothermia thermoregulation in the body (Sayyid et al., 2003).

Clinically hypothermia can cause adverse reactions and place patients at increased risk for multiple complications perioperatively. Some of the most critical complications have effects on cardiovascular, coagulation, infection, healing, and overall patient stress levels (Doufas, 2003). Furthermore, post-operative shivering has been linked to cardiovascular events that have

led to myocardial infarctions from an estimated increase of metabolic demands by as much as 500% placed on the body. The changes associated with the increased metabolic demands inflict hemodynamic stress stemming from a hypothermic sympathoadrenal response (Doufas, 2003). Moreover, a sympathoadrenal response is initiated from as little as a 1°C drop from baseline causing an initiation of a “sympathoneural (noradrenalin, norepinephrine) and adrenomedullary (adrenalin, epinephrine)” reaction (Doufas, 2003, p. 537). These are the excitatory responses that can cause the cardiovascular system to become compromised and increase morbidity.

Doufas (2003) found hematologic effects of hypothermia caused a change with coagulation stability consisting of platelet and clotting factor functions and fibrinolytic responses. Additionally, platelet counts do not change unless the patient has been moderately to severely hypothermic with an increased platelet adhesion to fibrinogen from the activation of GPIIb-IIIa receptors. Furthermore, there is a decrease in thrombin production, along with heparin mimicking anticoagulants. Doufas (2003) noted the assessment of clotting factors is documented to be accurate if the testing was conducted at 37°C, while the samples have been noted to be inaccurate from patients who were sampled at 35°C. Moreover, fibrinolysis is not altered, although hypothermia does alter the clot formation. According to the literature an estimated 200-300ml increase in blood loss can be expected with as little as a 0.5°C drop in core temperature (Doufas, 2003).

Doufas (2003) also concluded wound infection and healing have been compromised from perioperative hypothermia, ultimately delaying patient recovery. In addition an impaired immune function was also noted from an estimated 1°C core temperature change proceeded by an altered lymphocyte activation and neutrophil function. The altered neutrophil function progressed to

vasoconstriction of subcutaneous tissue then compromising wound healing due to tissue hypoxia (Doufas, 2003).

With duramorph hypothermia the common characteristics for many of the patients studied was displayed as paradoxical symptoms of hyperthermia, mainly the diaphoresis and the sensation of feeling hot; the patients also experienced prolonged hypothermia that did not resolve upon the maximal duration of the anesthetic (Hess, Snowman, & Wang, 2005). The noted symptoms were found to have occurred regardless of the duramorph dose used intrathecally (Case Reports In Anesthesia, 2013).

There are a few things noted during the analysis of this type of hypothermia that should be mentioned in order to determine that intrathecal morphine is ultimately the cause of this phenomenon. First, the hypothermia experienced by the subjects studied in the journals researched was concluded that it was not due to sympathectomy after regional anesthesia and surgical heat loss; because the patients exhibited diaphoresis and did not shiver. Moreover, regional anesthesia does lower the temperature threshold for shivering and vasoconstriction by approximately 0.5°C, it does not ablate these normal responses. These unique findings are opposite of the findings normally associated with hypothermia and more consistent with hyperthermia seen clinically. The research in concluding this is due to a central effect on thermoregulation.

Secondly, the symptomatic hypothermia had no response to active warming and had a delayed temperature increase after return of sympathetic function. If the hypothermia was due to the sympathectomy it would be an expected finding that the temperature would return back to normal as sympathetic function returned. Moreover, the length of hypothermia cumulatively between the articles was noted to be in excess of about 8 hours.

Finally, the treatment for this type of hypothermia is specific, with immediate cessation of symptoms after treatment with lorazepam. Ultimately, providing further evidence of the unusual nature of the hypothermia experienced by the patients in the research journals (Hess et al., 2005). Ironically, when researching the side effects of using lorazepam alone in a study using rats, hypothermia was noted as an adverse effect (Nikolov & Yakimova, 2010).

So what exactly is the mechanism of action for these clinically identified symptoms in humans after duramorph is used during a neuraxial anesthetic? Unfortunately, the side effects of morphine on thermoregulation are species dependent as well as dose dependent (Rawls & Benamar, 2008). In reviewing the literature the underlying mechanism is not well understood according to many articles. The thermoregulatory effects seen with opioids appear to be a complex interaction of the method of administration, environmental, and physiological conditions of the animal. Some authors have postulated that opioids act centrally to decrease the thermoregulatory set point, causing the body to perceive a normal temperature as a fever, spurring cutaneous vasodilation, sweating and heat loss (Rawls & Benamar, 2008). This effect is mediated via opioid-receptors in the central nervous system, although it is clearly a complex phenomenon (Hess et al., 2005). The endogenous opioid system, which consists of three G-protein-coupled receptors have been researched and described in animals such as mu, delta, and k-receptors and their respective ligands b-endorphin, enkephalin, and dynorphin, is widely distributed throughout the central and peripheral nervous system (Rachinger-Adam, Conzen, & Azad, 2011).

According to Ryan et al (2012) hypothermia caused from intrathecal morphine is possibly due to the central effect morphine has on thermoregulatory centers in the hypothalamus. This in turn,

may alter the body's temperature set point in the hypothalamus, which can result in the maladaptive changes, such as sweating and an absence of shivering that may exacerbate the hypothermia and contribute to the subjective sense of feeling warm, which is opposite to the effect of chills associated with a febrile patient. Basically the patient's ability to modulate their thermoregulatory area of the hypothalamus is altered causing an intrinsic thermostat temperature change. (Case Reports In Anesthesia, 2013, para. 9)

"The exact mechanism for morphine's effect on the hypothalamus has yet to be clearly defined" (Ryan et al., 2012, p.388). Opioid medications, including morphine, codeine, and oxycodone, are invaluable in medicine for their powerful painkilling and sedative effects (Buchen, 2012). As for fentanyl, it is presumed that hypothermic effects are not associated due to the drugs lipid solubility and short half-life (Gilandi & Ioscovich, 2015). Different treatments clinically have been researched and described in animals such as, naloxone, a mu-receptor antagonist, to be effective in treating hypothermia, while others have no effect. Unfortunately, the use of naloxone has inconsistently been reported to relieve the symptoms of duramorph hypothermia in conjunction with reversing the analgesic effects of the duramorph (Case Reports In Anesthesia, 2013). Additionally, other investigators have suggested that the k-receptors may be the primary mechanism of opioid-induced hypothermia. Moreover, peripheral nitric oxide production participates in the hypothermia caused by Kappa opioid receptor activation (Rawls & Benamar, 2008). Contrary, to Kappa producing hypothermia, mu opioid receptor activation results in hyperthermia when comparing the effects of morphine on the body (Rawls & Benamar, 2008).

During the animal studies the researchers found that pretreatment with diazepam prevented morphine-induced hypothermia in rats, while flumazenil, a benzodiazepine antagonist,

potentiated the hypothermic action of morphine. Similarly to the animal studies, the human subjects with duramorph hypothermia were given low dose lorazepam of 0.5-1mg sublingual or IV push and the only side effect noted is that it caused minimal sedation, but use caution after neuraxial morphine due to increased side effects of drowsiness, dizziness, and difficulty concentrating (Hess et al., 2005). Within about 90 minutes the patient's symptoms resolved and normothermia was reestablished. Additionally, midazolam in a dose of about 1-2 mg can also be used in the same manner as lorazepam but would need to be re-dosed because the effect is transient with the return of both the hypothermia and the other various symptoms, because of this result lorazepam is superior to treat the effects of duramorph hypothermia (Hess et al., 2005). Finally, if durpmorph hypothermia is suspected and subsequently treated with lorazepam, and the duramorph was not the cause or the hypothermia was misdiagnosed, the patient will not be harmed from this treatment regimen, the above mentioned side effects have the potential to occur.

Prior to making a final diagnosis of duramorph hypothermia the following differential diagnoses should be excluded: infection, hypovolemia, endocrinopathy, environmental conditions, and any iatrogenic causes from anesthetics. Infection and sepsis are a risk with any surgery in addition the spinal anesthetic could also be the culprit. Any surgical patient has the potential for hypovolemia from large blood loss. Endocrinopathy from hypoadrenalism or hypothyroidism have also been associated with hypothermia due to altered metabolisms and thermal regulation. Environmental conditions are always potential causes from cold operating rooms, unheated IVF, and/or surgical wound heat loss. Lastly, any iatrogenic causes will need to be ruled out from any administered anesthetics that may have caused changes in set-points of thermo-regulators, vasodilatation from sympathetic tone loss, regional induced sympathectomy

with hypothermia, and a dis-balance to shivering and vasoconstriction mechanisms (Gilandi & Ioscovich, 2015).

How exactly does lorazepam work to abolish duramorph hypothermia?

Lorazepam binds to benzodiazepine receptors, which are subunits of gamma-aminobutyric acid-A (GABA_A) receptors, and enhance the effect of GABA on GABA_A receptors. Although benzodiazepine receptors are found mostly in the cerebral cortex, they are also found in the hypothalamus. Binding of benzodiazepine receptors and its effect on GABA-related activity in the hypothalamus may modulate thermoregulation. The role of GABA receptors in thermoregulation is supported by animal studies in which the administration of GABAergic substances in the central nervous system affects thermoregulation. Ultimately, it is unclear which mechanism morphine and lorazepam affect thermoregulation. (Ryan et al., 2012, p. 387-88)

Project Description

The capstone project provided graduate anesthesia students from Adventist University of Health Sciences from both 1st and 2nd year Nurse Anesthesia Program (NAP) an increased knowledge base on duramorph hypothermia and its treatments. The project goal was to increase anesthesia providers' overall understanding of the hypothermia induced by the use of intrathecal duramorph for the most common procedure in obstetrics and orthopedics.

A wide and diverse review of literature was researched and concluded with a graduate level presentation. The presentation was held at Adventist University of Health Sciences and was delivered to both 1st and 2nd year NAP students in the fall of 2015, during an allotted 1 hour lecture performed in the clinical conference course.

Evaluation Plan

The purpose of this capstone presentation was to increase the anesthesia providers' knowledge of the potential side effects to the use of duramorph as an adjunct with intrathecal anesthesia. 1st and 2nd year graduate nurse anesthesia students were presented to during the fall of 2015 during their clinical conference course. Prior to beginning the presentation, all participants who volunteered to participate signed an informed consent. The informed consent discussed the topic's purpose, risk, benefits, participation, and confidentiality.

The presentation started with pre-presentation testing consisting of 15 questions. The reason for pre-testing was to assess the audience's existing knowledge of the presented topic. The presentation closed with a post presentation test. The purpose of post-presentation testing was to assess the providers' overall gained understanding, material retention, and knowledge on how to diagnose and treat duramorph hypothermia. In order to keep participants' confidentiality all participants received a number that was their personal identifier for both the pre and post-test. The investigators did not have the ability to name any of the participants from their testing results.

The post-presentation testing goal was to have an increase of overall testing results greater than pre-presentation testing results. It was the responsibility of the investigators of the project to conduct the testing and measure the results. The investigators requested the assistance of Dr. Lukman for research analysis review from the Scientific Review Committee using a classic paired t-test. Due to research purposes, all investigators on this capstone project were currently actively certified in Collaborative Institutional Training Initiative (CITI).

Results and Conclusions

The PreTest and PostTest results were analyzed by Dr. Roy Lukman, using a t-test for paired samples. The results in the table below show that the PreTest mean score is 5.825 and PostTest mean score is 13.550, which suggests a significant increase.

Paired Samples Statistics

| | | Mean | N | Std. Deviation | Std. Error Mean |
|--------|----------|---------|----|----------------|-----------------|
| Pair 1 | PreTest | 5.8250 | 40 | 2.52056 | .39853 |
| | PostTest | 13.5500 | 40 | 1.41331 | .22346 |

The table below is the t-test for paired samples confirmed that there is a significant increase of mean scores between PreTest and PostTest ($p < .000$).

Paired Samples Test

| | | Paired Differences | | | | | t | df | Sig. (2-tailed) |
|--------|--------------------|--------------------|----------------|-----------------|---|----------|---------|----|-----------------|
| | | Mean | Std. Deviation | Std. Error Mean | 95% Confidence Interval of the Difference | | | | |
| | | | | | Lower | Upper | | | |
| Pair 1 | PreTest - PostTest | -7.72500 | 2.48057 | .39221 | -8.51832 | -6.93168 | -19.696 | 39 | .000 |

The analyzed data showed a significant increase in knowledge from PreTest to PostTest results. Prior to the presentation to SRNAs the PreTest results were poor, proving that a prior understanding of duramorph hypothermia including treatment options not evident. Interestingly, there was one particular question that was missed the most and in some instances the only question missed. The question may not have been worded correctly, interpreted as a double negative, or simply a poor choice of words on the presenters' behalf. It was made clear to the presenters after the presentation that many had never heard of duramorph hypothermia.

The presentation and power point aid utilized, demonstrated a significant increase in the underlying knowledge to the SRNAs as evidenced by the increase in PostTest scores. It is safe to conclude that the presented material was adequately presented and conveyed. The education model showed to have increased the underlying knowledge of SRNAs that are currently practicing anesthesia and the risks associated with the use of a routine anesthetic adjunct management, in conjunction with what duramorph hypothermia really is, how to diagnose, and how to treat it. In conclusion, the SRNAs will have the advantage of learning about particular risks their patients can have and also the ability to share the information they learned with other practitioners as well.

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Appendix A

ADU NAP CAPSTONE PROJECT – INFORMED CONSENT

Our names are Ruthie Nicastro and Maria Sostre-Beltran, we are MSNA students in the Nurse Anesthesia Program (NAP) at Adventist University of Health Sciences (ADU). We are doing a Capstone Project called Understanding Intrathecal Duramorph Complications: Duramorph Hypothermia. This project is being supervised by Dr. Tolosa, DNAP, CRNA. We would like to invite you to participate in this project. The main purpose of this form is to provide information about the project so you can make a decision about whether you want to participate.

WHAT IS THE PROJECT ABOUT?

The purpose of this project is to increase awareness and medical understanding of duramorph hypothermia.

WHAT DOES PARTICIPATION IN THIS PROJECT INVOLVE?

If you decide to participate in this project, you will be asked to complete an anonymous pre-assessment, attend a classroom presentation, and then complete an anonymous post-assessment. The assessment will address questions from the presentation content. Your participation by attendance at the presentation and completion of the survey is anticipated to take approximately 45 minutes

WHY ARE YOU BEING ASKED TO PARTICIPATE?

You have been invited to participate as part of a convenience sample of students currently enrolled in the ADU NAP. Participation in this project is voluntary. If you choose not to participate or to withdraw from the project, you may do so at any time.

WHAT ARE THE RISKS INVOLVED IN THIS PROJECT?

Although no project is completely risk-free, we don't anticipate that you will be harmed or distressed by participating in this project.

ARE THERE ANY BENEFITS TO PARTICIPATION?

We don't expect any direct benefits to you from participation in this project. The possible indirect benefit of participation in the project is the opportunity to gain additional knowledge about duramorph hypothermia.

HOW WILL THE INVESTIGATORS PROTECT PARTICIPANTS' CONFIDENTIALITY?

The results of the project will be published, but your name or identity will not be revealed. To maintain confidentiality of assessments, the investigators will conduct this project in such a way to ensure that information is submitted without participants' identification. Each participant will be handed two individual test one pre and one post both will have an individual number. The number will be their only personal identifier in order to cross reference the examiners test. Thus, the investigators will not have access to any participants' identities.

WILL IT COST ANYTHING OR WILL I GET PAID TO PARTICIPATE IN THE PROJECT?

Your participation will cost approximately 60 minutes of your time, but will require no monetary cost on your part. You will not be paid to participate.

VOLUNTARY CONSENT

By signing this form, you are saying that you have read this form, you understand the risks and benefits of this project, and you know what you are being asked to do. The investigators will be happy to answer any questions you have about the project. If you have any questions, please feel free to contact Ruthie Nicastro Email: Ruth.Nicastro@my.adu.edu or Maria Sostre-Beltran Email: Maria.Sostre-Beltran@my.adu.edu. If you have concerns about the project process or the investigators, please contact the Nurse Anesthesia Program at (407) 303-9331.

Participant Signature

Date

Participant Name (PRINTED LEGIBLY)

Appendix B

Duramorph Hypothermia Capstone questions

1. Which answer best describes duramorph hypothermia?
 - a. Low temperature, feeling cold, shivering
 - b. Low temperature, diaphoresis, feeling hot
 - c. Low temperature, feeling hot and cold simultaneously
 - d. Low fever, sweating, and diaphoresis
2. How do you treat duramorph hypothermia?
 - a. Forced air warming blanket, warmed crystalloids, warm bladder irrigation
 - b. Low dose sublingual lorazepam 1mg
 - c. Acetaminophen 650mg
 - d. Ibuprofen 800mg
3. The duration of duramorph hypothermia can persist for approximately _____ to _____ hours?
 - a. 9-36 hours
 - b. 6-24 hours
 - c. 1-2 hours
 - d. 2-4 hours
4. What percentage of patients may present with symptoms of duramorph hypothermia after intrathecal injection with duramorph?
 - a. 1-2 %
 - b. 0.5-1%
 - c. 20-25%
 - d. 6-7%
5. Side effects of intrathecal duramorph are?
 - a. Itching
 - b. Respiratory depression
 - c. Nausea
 - d. Hypothermia
 - e. A, B, & C
 - f. A, B, & D
 - g. All the above
6. Hypothermia is considered a decrease in baseline temperature of _____ ° C?
 - a. 1° C
 - b. 2° C
 - c. 0.5° C
 - d. 5° C
7. What are the potential clinical complications related to hypothermia?

- a. Increased wound healing
 - b. Coagulopathy
 - c. Increased metabolic demands
 - d. Decreased metabolic demands
 - e. A & D
 - f. B & C
8. _____ counts change with moderate to severe hypothermia.
- a. Platelet
 - b. WBC's
 - c. PT/INR
 - d. RBC's
9. Duramorph hypothermia has been linked to _____ doses of intrathecal duramorph?
- a. Small
 - b. High
 - c. Both
 - d. Neither
10. Can Narcan relieve the symptoms of duramorph hypothermia?
- a. Yes
 - b. No
 - c. Controversial
 - d. Never
11. How long after initiation of the appropriate treatment intervention will normothermia occur?
- a. Within 90 mins
 - b. Within 10 mins
 - c. Within 5 mins
 - d. Within 2 hours
12. Patient received intrathecal injection of duramorph for a C-section, 30 minutes after the intrathecal injection post procedure vital signs were taken with a mild drop in temperature, is this a normal finding?
- a. No, this is not normal after intrathecal administration
 - b. Yes, this is a normal finding that can persist for several hours without causing any medical concerns.
 - c. Yes, this is a normal finding that can normally have a duration of 90 minutes before returning to baseline temperature. If hypothermia persist with symptoms treatment is needed.
13. What is the main cause of a temperature drop after an intrathecal injection?
- a. IV Fluid bolus & cold exposure
 - b. Disrupted thermoregulatory response causing an false sense of warmth
 - c. Vasoconstriction below the block level

- d. A high spinal
14. During a neuraxial anesthetic with the addition of PF duramorph, the patient experienced some of the side effects mentioned below. Which side effects are specific for duramorph hypothermia?
- a. The hypothermia remained long after regression of spinal anesthesia and despite active warming
 - b. Their symptoms are not consistent with heat loss due to a sympathectomy
 - c. Both hypothermia and associated symptoms were successfully treated with lorazepam.
 - d. A & C
 - e. A, B, & C
 - f. A & B
15. The central effects of morphine on thermoregulation occur from which part of the brain?
- a. Hypothalamus
 - b. Pituitary
 - c. Pons
 - d. Thalamus
 - e. Cerebellum

Appendix C

Power Point Presentation

10/28/15'

Welcome


- Thank You for participating in our capstone project.
- Please read and sign your participation consent.
- Pre & Post 15 minute test will be handed out.
- Everyone's participation will remain anonymous using a number system.
- THANK YOU!

Understanding Intrathecal
Duramorph Complications:
Duramorph Hypothermia

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Objective

- ✓ Educate anesthesia providers with an expanded understanding of duramorph hypothermia, how to diagnosis, and how to treat.
- ✓ Graduate presentation presented to both 1st & 2nd SRNAs at ADU
- ✓ Increase provider understanding in order to bring light to an often misdiagnosed and mismanaged treatable adverse effect to a common anesthetic plan



Case Scenario

- 25y/o female G2P1 38wks parturient w/ twin gestation, healthy pregnancy, & scheduled for C-Section @ 0830
- Patient reports a previous normal vaginal delivery w/ labor epidural, denies any issues w/ prior neuraxial anesthetic.
- Your plan is a spinal anesthetic

Case Scenario

- The surgery takes about 90 minutes & is unremarkable
- Patient arrives to PACU initial vitals are stable except for her temperature, which is less than 36°C
- 15 minutes later the patient is reassessed & noted the temperature is now reading 35.5°C, she is now complaining of feeling hot & is observed to be diaphoretic.



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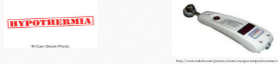
Routine Hypothermic Treatment Measures

- Warm Blankets
- Increase Room Temperature
- Forced Air Warming Blankets (Bair Hugger)
- Warmed IVF
- Warm Bladder Irrigation with NS through Foley Catheter



How Is Hypothermia Defined?

Hypothermia is normally a **drop** in temperature of **1°C** from baseline or a temperature between 34°C & 36°C from core body temperature readings



Thermal Regulation


- Body controls its temperature from the **hypothalamus**, which receives sensory information from the skin's surface, deep tissues, and nervous system via spinothalamic tract
- Peri-Operative hypothermia occurs from either an increase in heat loss from the body's exposure to colder surroundings (Convection, Radiation, Evaporation, Conduction) or from abnormal thermoregulation mechanisms in the brain and spinal cord
- Alterations to thermal regulation occurs w/ most anesthetic techniques

Normal Regional/Neuraxial Hypothermia

- Prevents regional manifestation of major thermoregulatory defenses including sweating, vasoconstriction, and shivering
- 1st a temperature drop of **1-2°C** from vasodilation caused from the sympathectomy with a duration of **60-90 minutes**
- 2nd post regional impaired thermoregulation caudad from sympathetic block, **Disrupted thermoregulatory responses causing a false sense of warmth.**
- The body's innate response to cause vasoconstriction or shiver is altered

Clinical Complications From Hypothermia

- Cardiovascular
- Coagulation
- Infection
- Wound Healing
- Increased Recovery Time & Increased Length of Stay (LOS)



Cardiovascular Effects From Hypothermia

- Post-Op shivering linked to CV events some leading to MI from an **increased metabolic demand** of approximately 500%
- ↑ ↑ O₂ Consumption
- Hemodynamic stress from hypothermic sympathoadrenal response initiated from as little as a 1°C drop in temperature from baseline
 - ↑ ↑ Sympathoadrenal Effects (norendrenaline, norpinephrine)
 - ↑ ↑ Adrenomedullary Effects (adrenaline, epinephrine)
- Overall an increased excitatory responses causes CV compromise & increases morbidity

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Case Scenario Conclusion

- Initially, usual warming measures were utilized to attempt to combat the hypothermia which included a fluid warmer, warm blankets and warmed saline through the urinary catheter without any success.
- 5 hours after the spinal anesthetic was administered the patient's temperature is stable at 35.5°C she remains diaphoretic, feeling hot, and generally feeling miserable. The astute CRNA notices that the patient oddly is not shivering and non responsive to conventional hypothermic treatments.

Case Scenario Conclusion

- The CRNA remembers a lecture in class about "duramorph hypothermia" and the side effects are matching up with the patients symptoms.
- With a diagnosis of duramorph hypothermia now made, the patient is treated with 1mg of sublingual lorazepam in addition to the usual warming measures already implemented
- 30 minutes later the patient is not diaphoretic or feeling hot and is now normothermic at 36.8°C the rest of the patients stay was unremarkable

CRNA's Role

- ALWAYS ASSESS the patient FIRST!
- Take note of patient's symptoms onset, duration, & already attempted treatments
- R/O any other possible causes of hypothermia
- Report to OB Anesthesiologist
- Suggest low dose lorazepam if the symptoms fit the treatment measure
- ALWAYS REASSESS after any intervention!

Conclusion

- Duramorph hypothermia is not well known, occurs approximately **6-7%** in patients who received intrathecal duramorph. EX: OB/ORTH/O surgeries.
- Hypothermia is a decrease in core temp of 1°C**
- Prolonged hypothermia up to **6-24hrs** & possible negative side effects 3°C fix ASAP
 - Platelet counts change w/ moderate to severe hypothermia**
 - Increased coagulopathy**
 - Increased metabolic demands**
 - Decreased wound healing**
- Patients presented hypothermic w/ paradoxical symptoms of hyperthermia, **sensation of feeling hot, diaphoresis, nausea & no shivering.**

Conclusion

- Intrathecal duramorph S/E: itching, resp depression, Nausea, & feeling hyperthermic**
- Dose amount does not matter**
- Treat with low dose Lorazepam 1mg & symptoms resolve within 90 mins
- Narcan is controversial**
- Ultimately if you have exhausted all other treatment modalities giving lorazepam to your patient will **NOT** cause any harm if a miss diagnosis is made.

Thanks for listening!
Any Questions?
No?
SUPER!

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