Ain Shams University
Faculty of Medicine
Department of Anesthesia, Intensive Care & Pain Management

Prophylactic use of Parenteral Ketamine versus Ondansetron for Prevention of Shivering during Spinal Anesthesia in Hernia Surgeries

Thesis

Submitted for Fulfillment of Requirements of Master Degree in Anesthesiology

By

Aya-tullah Hosny Kamal El-Deen Abd El-Aleem
M.B., B.Ch, Ain Shams University

Under Supervision of

Prof.Dr. Nabila Mohammed Abdel Aziz Fahmy
Professor of Anesthesiology, Intensive Care Medicine & Pain Management
Faculty of Medicine, Ain Shams University

Dr. Ayman Ibraheem Tharwat Sayed
Assistant Professor of Anesthesiology, Intensive Care Medicine & Pain Management
Faculty of Medicine, Ain Shams University

Dr. Amr Hosny Hamza Ali
Lecturer of Anesthesiology, Intensive Care Medicine & Pain Management
Faculty of Medicine, Ain Shams University

Faculty of Medicine
Ain Shams University
2018

سورة البقرة الآية: ٣٢

Acknowledgment

First and foremost, I feel always indebted to ALLAH, the Most Kind and Most Merciful.

I'd like to express my respectful thanks and profound gratitude to ***Prof. Dr. Nabila Mohammed Abdel Aziz Fahmy,*** *Professor of Anesthesiology, Intensive Care Medicine & Pain Management, Faculty of Medicine, Ain Shams University, for her keen guidance, kind supervision, valuable advice and continuous encouragement, which made possible the completion of this work.*

I am also delighted to express my deepest gratitude and thanks to ***Dr. Ayman Ibraheem Tharwat Sayed,*** *Assistant Professor of Anesthesiology, Intensive Care Medicine & Pain Management, Faculty of Medicine, Ain Shams University, for his kind care, continuous supervision, valuable instructions, constant help and great assistance throughout this work.*

I am deeply thankful to ***Dr. Amr Hosny Hamza Ali,*** *Lecturer of Anesthesiology, Intensive Care Medicine & Pain Management, Faculty of Medicine, Ain Shams University, for his great help, active participation and guidance.*

I would like to express my hearty thanks to all my family for their support till this work was completed.

Last but not least my sincere thanks and appreciation to all patients participated in this study.

Aya-tullah Hosny

List of Contents

Title Page No.

List of Tables

List of Figures

List of Abbreviations

Abb.	Full term

5-HT3.....5-hydroxytryptamine
Ad.....A- delta
ASA .....American Society of Anaesthesiologist
BP ..... Blood pressure
CBC .....Complete Blood Count
ECG..... Electrocardiogram
EMG.....Electromyography
IV .....Intravenous
KFT .....Kidney Function Tests
LFT .....Liver Function Tests
MBP.....Mean blood pressure
NIBP.....Noninvasive blood pressure
PACU .....Postanesthesia Care Unit
PT .....Prothrombin Time
PTT .....Partial Thromboplastin Time
RBS.....Random Blood Sugar
SD.....Standard deviation
VS.....Versus
X2.....Chi-square

INTRODUCTION

Perioperative shivering is a common complication in modern anesthesia. It's usually defined as readily detectable fasciculations or tremors of the face, jaw, head, trunk or extremities lasting longer than 15 seconds ***(Palan and Agrawa, 2017).***

Shivering is uncomfortable for the patient and may interfere with monitoring of electrocardiogram, blood pressure (BP), and oxygen saturation. It increases oxygen consumption, lactic acidosis and carbon dioxide production. Those effects are particularly bothersome in the surgical population ***(Torossian et al., 2013).***

Regional anesthesia may impair thermoregulatory control and up to a 57% incidence of shivering during regional anesthesia has been reported. Regional anaethesia produces vasodilatation, which facilitates core-to-peripheral redistribution of heat ***(Honarmand and Safavi, 2008).***

Postoperative shivering occurs in 5-65% of patients recovering from general anaesthsia. This may be normal thermoregulatory shivering in response to core hypothermia or may result from the release of cytokines by the surgical procedure. The core temperature usually decreases by 0.5-1.5 c in the first hour after induction of anaesthia. All general anaesthetics markedly impair normal thermoregulatory control.

However, non-thermoregulatory shivering may also occur in normothermic patients in response to certain anaesthetics or postoperative pain ***(Pazderska et al., 2013).***

The treatment of shivering includes both pharmacological and non-pharmacological methods. The non-pharmacological management is by external heating like the use of forced air warming, warming blankets, warmed fluids etc., according to the results of a meta-analysis, the most frequently reported pharmacological interventions include clonidine, pethidine, tramadol, nefopam and ketamine ***(Park et al., 2012).***

Unfortunately, no gold standard treatment is known for shivering as the administration of all the available drugs is associated with various adverse effects.

Recently ketamine and ondansetron have been tried to prevent shivering during anesthesia with good results. Ketamine a competitive NMDA receptor antagonist has a role in thermoregulation at various levels. NMDA receptor modulates noradrenergic and serotoninergic neurons in locus ceruleus. It is used as antishivering agent in dose of 0.5-0.75 mg/kg IV. But even in these doses it causes side effects i.e. drowsiness, hallucination and delirium ***(Sagir et al., 2007).***

Ondansetron is 5-HT3 receptor antagonist, primarily used to prevent emesis. Recently it has also been tried

successfully for prevention of shivering in dose of 8mg IV without any side effects ***(Park et al., 2012).***

The mechanism of 5-HT3 antagonists in the regulation of body temperature has not been clarified, but it may be related to the inhibition of serotonin uptake on the preoptic anterior hypothalamus region ***(Park et al., 2012).***

As there are very few studies in relation to use of prophylactic ketamine and ondansetron for prevention of shivering during spinal anesthesia. So we conducted the present study to evaluate and compare the relative efficacy and safety of low dose ketamine (0.25 mg/kg) and ondansetron (4 mg) for prevention of shivering during spinal anesthesia.

AIM OF THE WORK

Compare the anti-shivering effect of parentral low dose ketamine and ondansetron after spinal anesthesia during hernia surgery, as well as the anticipated side effects and complications.

REVIEW OF LITERATURE

Heat and Thermoregulation

- ***Physics of Heat Transfer:***

Heat loss occurs primarily from the skin of a patient to the environment through several processes, including radiation, conduction and convection, and evaporation. Of these, radiation is most significant and accounts for 60% of total heat loss. Radiation is emitted in the form of infrared rays, a type of electromagnetic wave. Heat from core body tissues is transported in blood to subcutaneous vessels, where heat is lost to the environment through radiation. This manner of heat loss is the basis for the familiar technology used to sense and identify the locations of persons in buildings who are out of normal view. Radiation is the major source of heat loss in most surgical patients ***(Guyton and Hall, 2006).***

Conduction refers to loss of kinetic energy from molecular motion in skin tissues to surrounding air. Water absorbs far more conducted heat than air, and this accounts for more rapid hypothermia during accidental drowning, as well as the efficacy of water baths to cool hyperthermic patients. For this to be effective, warmed air or water must be moved away from the skin surface by currents, a process called convection. This accounts for the cooling effect of wind and laminar air flow in many surgical suites. Conduction and convection account for 15% of body heat loss ***(Morgan et al., 2006).***

Roughly 22% of heat loss occurs by evaporation, as energy in the form of heat is consumed during the vaporization of water. Water evaporates from the body even when not sweating, but mechanisms that enhance sweating increase evaporation. As long as skin temperature is greater than its surroundings, radiation and conduction provide heat loss. At very high environmental temperatures, these processes cannot work, and evaporation is the only manner in which heat can be dissipated. This generally is not the case in the clinical setting ***(Hanania and Zimmerman, 2005).***

- ***Fundamental Processes in Thermoregulation:***

Skin temperature rises and falls with the temperature of a patient's surroundings. However, the temperature of deep body tissues, that is the core temperature, remains relatively constant at 37°C (98.0°F to 98.6°F). In fact, core temperature normally remains between 36°C and 37.5°C (97°F and 100°F), even while environmental temperatures fluctuate from as low as 12.5°C (55°F) to as high as 54°C (130°F). This is due to a remarkable thermoregulatory system that is conventionally organized into three components: afferent sensing, central control, and efferent responses ***(Guyton and Hall, 2006).***

Afferent Sensing

Afferent input is triggered by thermal-sensitive cells (receptors) found not only in skin but throughout most of the body. Receptors for cold are anatomically and physiologically distinct from those for heat. Cold receptors are excited by temperatures below a set threshold and generate impulses that travel mainly via Ad (A- delta) nerve fibers. Temperatures above threshold excite heat receptors that generate impulses along unmyelinated C fibers, which also conduct pain sensation. For this reason, patients frequently are unable to discriminate between sharp pain and intense heat. Information is then integrated at several levels within the spinal cord and brain, finally arriving at the primary thermoregulatory center within the hypothalamus ***(Sessler, 2005).***

Central Control

Although some integration and temperature regulation may occur at the spinal cord level, the hypothalamus is the primary center for thermoregulatory control, integrating most afferent input and coordinating the various efferent outputs required to maintain a normothermic level. The precise manner by which the body establishes temperature thresholds is unclear, but it appears to involve the interactions of several neurotransmitters, including norepinephrine, dopamine, 5-hydroxytryptamine (serotonin), acetylcholine, prostaglandin E1, and other neuropeptides. Additional factors such as circadian rhythm, exercise, food intake,

infection, thyroid dysfunction, menstrual cycle, anesthetics, and and other drugs are known to alter temperature thresholds ***(Guyton and Hall, 2006).***

Efferent Responses

Behavior is the most effective response for thermoregulation. This includes dressing appropriately, modifying environmental temperature, assuming bodily positions that diminish or enhance heat loss, and increasing voluntary movement to generate heat production ***(Buggy and Crossley, 2000).*** Obviously, these considerations must be addressed before a patient is anesthetized and will be considered later in this review.

As temperature receptors transmit information to the hypothalamus, it is integrated and compared with threshold settings. Values above or below these thresholds determine the efferent response that is generated (Figure 1). Efferent outputs from the hypothalamus regulate body temperature by altering subcutaneous blood flow, sweating, skeletal muscle tone, and overall metabolic activity ***(Sessler, 2008).***

Heat loss is promoted by vasodilation and sweating, while heat is conserved by inhibiting these processes. Production of heat (thermogenesis) is promoted by shivering and increases the overall metabolic rate. These influences are summarized in (Table 1) ***(Guyton and Hall, 2006).***