

Effects of Anesthetics on Some Hematological and Biochemical Parameters in Patients Undergoing Surgery in Misurata, Libya

¹ Salma Ahmad Awad, ² Afaf Musbah Mohammed, ³ Nosiba Mustafa ali, ⁴ Nada al kilani algal, ⁵ Randa Mohammed AlSalhi, ⁶ Fatma Milad Alzain, ¹ Omar Al-mukhtar University, ¹ Faculty of Medicine, ² Tripoli university, ² Faculty of Medicine, ^{3,4,5,6} Misurata University, ^{3,4} Faculty of Medicine, ^{5,6} Faculty of Health

sciences, ^{1,2,3,4} Department of Obstetrics and gynecology, ^{5,6} Department of Intensive Care.

¹ Email: salmaalgaithy86@gmail.com

³ Email: nosiba.91.ali@gmail.com

² Email: Afafmusbah2@gmail.com

⁴ Email: nada.gazal2009@gmail.com

Abstract— this study aimed to evaluate the effect of using some anesthetics on some vital signs and hematological and biochemical parameters in patients undergoing surgical operations in Misurata city. The study was conducted with 50 patients who underwent surgeries, during the period from May to August 2021, vital parameters were measured: blood pressure, body temperature, and heart rate, and 5 ml venous blood was drawn from all patients before anesthesia and after surgery, during a period Not more than 24 hours after the operation, to study the effect of anesthetics on some biological, blood and biochemical factors. The results showed significant changes in mean blood pressure before and after anesthesia ($P = 0.000$), heart rate ($P = 0.033$), hemoglobin concentration ($P = 0.000$), platelet count ($P = 0.082$), and creatinine concentration ($P = 0.021$). While there were no significant changes in body temperature ($P = 0.163$), white blood cell count ($P = 0.199$), red blood cell count ($P = 0.952$), urea concentration ($P = 0.732$), blood salts: sodium ion ($P = 0.225$), and Potassium ($P = 0.870$), it can be concluded that anesthetics have little effect on biotic factors, hematological and biochemical parameters

Keywords- Anesthesia, Hematological and Biochemical Parameters, Patients and Surgery.

I. INTRODUCTION

A. Definition of anesthesia:

Anesthesia is a state of controlled, temporary loss of sensation or awareness that is induced for medical purposes (Malamed, 2004). It is given to the patient a low-dose anesthetics prescribed by a doctor and can be determined according to the weight, age, and health status of the patient.

B. The importance of anesthesia:

Helping the patient to undergo medical procedures and surgeries without pain or suffering. 1.3- The background: The

science of surgical anesthesia was only discovered in the last hundred years, after the discovery of anesthetics that are inhaled such as Ethel and nitrous oxide (Robinson & Toledo, 2012). These substances have recently evolved significantly into inhaled anesthetics such as Isoflurane and Cefoflurane intravenously such as Propofol, which showed an unprecedented breakthrough in the science of anesthesia because it helps the patient to enter the anesthesia quickly and recover from him quickly at the end of the surgery (when inhalation stops) (Beilin et al., 1989). Thanks to these modern anesthesia materials, anesthesia has become very sophisticated, which has opened up an unprecedented wide range of anesthesia in 3 many major surgeries such as open-heart operations, nerve operations, brain tumors, and organ transplantation (Beilin et al., 1989). It also led to what is known as anesthesia Balanced, which means anesthesia is done from the balance between several types and a component of inhalation anesthesia with intravenous anesthesia with muscle relaxants and with analgesic substances such as morphine derivatives such as a substance Pethidine and Fentanyl, and thus the doses taken of each type became low, which preserves the safety of the patient's life by not taking large doses of one type of anesthesia (Beilin et al., 1989). Anesthesia has major risks and minor risks. Examples of major risks include death, heart attack, and pulmonary embolism, while secondary risks include vomiting and nausea after the operation. Studies have shown changes in the general physiological and immune responses of the body during anesthesia and surgery. These changes depend on several factors, including the extent of surgery, the patient's age and health status, medications, and blood transfusion. Complications of inhaled, intravenous, or local anesthesia have significant effects on these responses, especially if given in higher concentrations or doses, or for longer periods than those clinically recognized (Hanley et al., 2010 ; Salo, 1992).

Other studies also showed that a large dose of Fentanyl or Fufentanil suppressed natural killer cell cytotoxicity (NKCC) in mice (Beilin et al, 1992 ; Beilin et.al, 1989).

C. Old anesthesia methods:

The peoples of the ancient world excelled in inventing ways to overcome pain while healing wounds or performing surgery, and one of the ways the Italians used 4 was to hit the patient with the hammer of the attending physician on the head until he lost consciousness. As for the peoples of the Incas, the Native Americans, the surgeon was sucking the leaves of the coca plant and spitting the anesthetic on the wound. Some people have resorted to the method of pressure isolating the nerve leading to the part where surgery is to be performed by placing a large rock on the site of the nerve to prevent the flow of blood to it until the patient loses sense of it. As for the ancient Egyptians, they excelled, in inventing methods of anesthesia, as they found on papyrus manuscripts that they used the poppy plant as a medical prescription to anesthetize the patient. During the dark ages in Europe, where ignorance and sorcery spread, surgeries were carried out without fear, believing that pain allowed sins. Attempts were made, and there were many ways, until the discovery of chloroform by the Subramanian.

D. Methods of anesthesia:

Intravenous injection: It is the injection of a drug and spreading it from the veins towards the nerves. - Inhalation gases: That is the use of anesthesia by inhalation with oxygen. Note: [Children are usually sedated with anesthetic gases, while adults are sedated intravenously (Salo, 1992).

E. Types of anesthesia:

The types of anesthesia include the following: 1- General anesthesia: Which is anesthesia for the whole body. It is the basis of anesthesia in many surgeries and is used when the operation is difficult and complicated. 2- Spinal anesthesia: It is anesthesia for a specific area of the body where surgery is performed. It is considered the modern trend in anesthesia because it does not expose the patient to the problems of general anesthesia, and it is in one of two ways: A - Local anesthesia for the site of the operation: Such as Xylocaine and Marcaine, and it is used in local anesthesia for the eyes, such as removing cataracts or glaucoma in the eye, or retinal operations of the eye, or operations to remove fatty cysts in the body, or any surgery for something visible on the surface of the skin (Beilin et al., 1989). B- Spinal anesthesia, and epidural anesthesia: The surgeries that are performed in the lower half of the body, such as hemorrhoids, inguinal hernia, and cesarean sections, or orthopedic surgeries such as the pelvis, thigh bones, leg, and feet (Beilin et al., 1992). Local anesthesia of all kinds is preferred over general anesthesia

because it is less dangerous than general anesthesia for the patient's life and this is the modern trend in the science of anesthesia. It is also recommended to do balanced anesthesia in the case of general anesthesia is not being exposed to high doses of only one type of substance (Beilin et al., 1992).

F. The risks of anesthesia drugs:

F.1 Risks of local anesthesia:

Local anesthesia is safe as it does not cause many side effects, however, if a high dose is used or used in the wrong way so that it gets into the vein, it may cause some side effects such as dizziness, tinnitus, metallic taste in the mouth. High doses of these drugs can cause dangerous side effects such as low blood pressure, slow heart rate, seizures in breathing (Beilin et al., 1992). In rare cases, local anesthesia can cause nerve damage or persistent pain and numbness and can cause systemic poisoning if the drug is absorbed through the bloodstream into the body, and other complications such as heart or lung problems, infection, swelling or bruising at the injection site. Local anesthesia can cause headaches due to anesthetic leakage and is more common in young adults (Beilin et al., 1989).

F.2 Risks of general anesthesia:

General anesthesia can cause some side effects that occur directly and do not last for a long time, such as feeling nausea and vomiting, shivering and feeling cold, confusion and memory loss, bladder problems, vertigo. General anesthesia can be associated with some complications, such as - sore throat, headache, and muscle pain. Serious allergic reaction to medication waking up during an operation (Beilin et al., 1992).

G. The duration of the exit of the anesthetic from the body:

The duration of the anesthetic exit from the body depends on the following: 1- The duration of the surgery and the process itself, for example, the duration of the cesarean section, the duration of anesthesia is less compared to the open-heart operation, and in general, once the operation is completed, the effect of anesthesia will begin to leave the body. 2- The type of anesthetic used, as the schedule for the anesthetic to leave the body varies depending on the type of anesthetic used (Nakao et al, 2001).

H. The side effects during the anesthetic period:

After completing the surgery, a patient will suffer from some side effects, which include the following: 1- Effects of total anesthesia: Its side effects include the following: Nausea and vomiting, sore throat, dryness in the mouth, muscle pain, itching, shiver, ataxia, drowsy ness, mild hoarseness, feeling

confused, chills, blurred vision, lack of focus. 2- Effects of local anesthesia: Its side effects include Headache, mild pain in the back, urination problems, bleeding under the skin where the medicine was injected, nerve damage in some cases (Nakao et al., 2001).

Inhalational anesthetics: The most important inhalational anesthetics are: Isoflurane: It is the best drug that can be used for anesthesia and has a quick result in the treatment of nervous system damage, as this drug has a positive effect on the health of those patients who suffer some neurological damage (Eger, 1984). - Chemical formula: $C_3H_2ClF_5O$

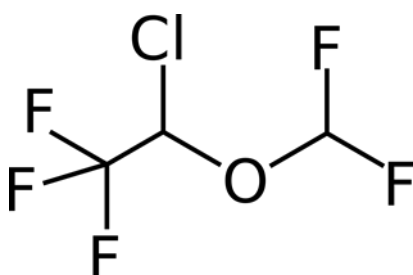


Figure (I): Chemical structure of Isoflurane

Trading name: Forane - The Use: It is used in the process of inducing anesthesia before starting the operation, and to maintain anesthesia during it. - Side effects: Shortness of breath, headache, heart rhythm disturbances, An increase in potassium and sugar, swelling in the face, severe heart failure, liver problems, sharp drop in blood pressure, severe nausea, and vomiting. - Contraindications: It is best to avoid this drug during pregnancy and breastfeeding. 9 It is forbidden in case of narrowing of the airways. Isoflurane is dangerous in the case of viral hepatitis, vascular disease, and kidney problems (Eger, 1984). 1.10.2- Sevoflurane: The treatment belongs to a group of therapies called general anesthetics, which are used for general anesthesia / anesthesia of patients before and during surgeries or for some painful or harmful medical procedures. The treatment is inhaled through the nose, and it depresses / anesthetizes the central nervous system so that the patient loses consciousness in a way that allows the operation to be performed, and the treatment is usually used in combination with other treatments to get a better effect. Treatment should be given under the supervision of an anesthesiologist (Patrl & Goa, 1996).

- Chemical formula: $C_4H_3F_7O$

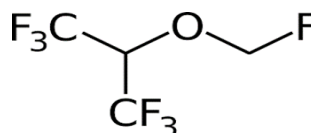


Figure (II): Chemical structure of Sevoflurane

Trading name: sevoflurane inhaled solution, sevoflurane Penta, Sephoran, Sojourn, sevoflurane, haloran. - The Use: It is used in the process of inducing anesthesia before starting the operation, and to maintain anesthesia during it. 10 - Contraindications: It is contraindicated in patients who have shown sensitivity to Sevoflurane or other halogens, or in patients who have or have had a genetic predisposition to 'malignant hyperthermia'. - The side effects: Dose pressure drop, slow heart rate, tachycardia, low blood pressure, hypertension, nausea / vomiting, respiratory irritation, nephrotoxicity, urine sugar, proteinuria, seizures, heart stop, cough, irritation, Increased salivation, airway obstruction, laryngospasm apnea (De Hert & Moerman, 2015 ; Patrl & Goa, 1996). 1.10.3- Desflurane: An anesthetic liquid for inhalation, described as a general anesthetic, that causes sleep during surgical procedures and care requiring sedation of the patient Chemical formula: $C_3H_2F_6O$

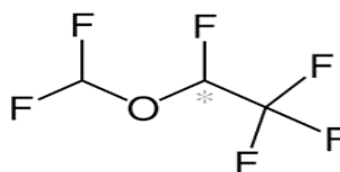


Figure (III): Chemical structure of Desflurane

Trading name: Suprane The Use: An inhaled liquid used to induce anesthesia before a surgical procedure. - Contraindications: Children, as it leads to damage to the upper respiratory tracts in children. - The side effects: signs of an allergic reaction, such as a rash, chills, redness, or flaking of the skin, signs of high or low blood pressure, such as severe headache or dizziness, change in eyesight, breathing problems, Fast or slow heartbeat (Patel & Goa, 1995) .

Halothane: The treatment belongs to the general drug group, as it numbs the central nervous system so that the patient loses consciousness in a way that allows the operation to be performed, and the treatment is usually used with other treatments to get a better effect. Chemical formula: $C_2HBrClF_3$

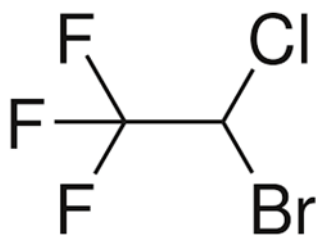


Figure (IV): Chemical structure of Halothane

Trading name: fluothane - The Use: It is used in the process of inducing anesthesia before starting the operation, and to maintain anesthesia during it. Contraindications: Not recommended in obstetrics due to increased risk of postpartum hemorrhage (except in certain cases determined by the physician). - The side effects: Low blood pressure, shudder, nausea and vomiting. - Nitrous oxide: (N_2O) is generally known as "laughing gas" or sweet air. It is a chemical compound of nitrogen oxides. At normal room temperature, it is a colorless, nonflammable gas with a slightly sweet odor and taste. It is used in surgery and dentistry because of its anesthetic and seizing effects (Becker & Rosenberg, 2008). - Chemical formula: N_2O

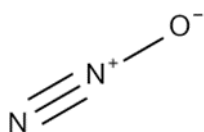


Figure (V): Chemical structure of Nitrous oxide

Trade name: Entonox, others - The Use: Its primary medical use is as an adjuvant in anesthetics for surgical operations, and its use alone is not sufficient to induce anesthesia while mixing it with oxygen greatly relieves pain. It has other uses for dentists, obstetrics, and gynecology. Contraindications: Not recommended for those with intestinal obstruction or pneumothorax. Its use in early pregnancy is not recommended and when breastfeeding. -

The side effects: Feeling of relaxation and numbness in the arms and legs, feeling sleepy, drowsy, mild headache. In some

cases, a person loses the ability to hear and speak, if you inhale a high dose, you will want to vomit and feel nauseous (Becker & Rosenberg, 2008).

Intravenous anesthesia:

Sodium thiopental: It is a fast-acting anesthetic and is also used as a truth serum. - Chemical formula: $\text{C}_{11}\text{H}_{17}\text{N}_2\text{NaO}_2\text{S}$

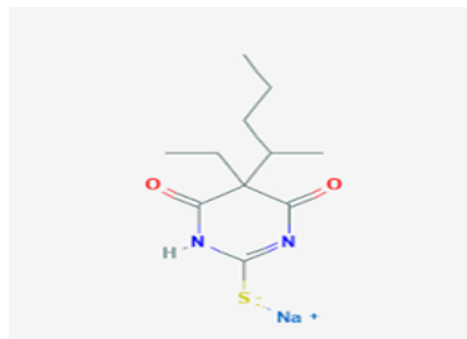


Figure (VI): Chemical structure of sodium thiopental

Trade name: Thiopental, Anapental, Thiopental Epico. - The Use: Induction of anesthesia, Narcosis, Anticonvulsant for status epileptics, Reduction of inter-cranial pressure. Contraindications: it is contraindicated in people who are allergic to Thiopental, to Barbiturates in general, or any other component of the treatment, or who suffer from severe heart or arterial disease, or who have a blood disorder called purpura, or who suffer from bronchial asthma (persistent asthma). - The side effects: Headache, dizziness, drowsiness, nausea, vomiting, loss of appetite, indigestion, rash. Ketamine: Ketamine belongs to a group of treatments called general anesthetics. It is used in general anesthesia/anesthesia of patients before and during surgeries or in some painful medical procedures where the treatment directly affects the central nervous system, separating the patient from the world around him (Miller, 2002). - Chemical formula: $\text{C}_{13}\text{H}_{16}\text{ClNO}$

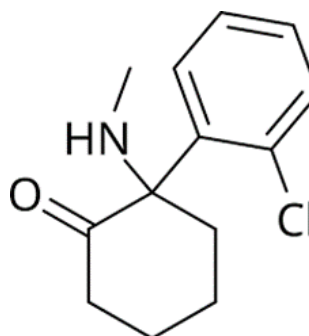


Figure (VII): Chemical structure of Ketamine.

B name: Kitala - **The Use:** It is used in the process of inducing anesthesia before starting the operation, and to maintain anesthesia during it. It is also used in veterinary medicine and anesthesia for children. **Contraindications:** It is contraindicated to use the treatment in people who have shown sensitivity to Ketamine, or in patients whose high blood pressure poses a threat to their health. **The side effects:** Hypertension, Increased cardiac output, Tachycardia, Pain at the injection site, Hallucinations, Laryngospasm, Urogenital system, dysuria, increased urinary frequency, urgency, enuresis, urinary incontinence, cystitis, Arrhythmia (Albozachri et al., 2012 ; Törneke et al., 2003). **Propofol:** It is a short-acting drug that leads to a decreased level of consciousness and impaired memory for events. - **Chemical formula:** C₁₂H₁₈O

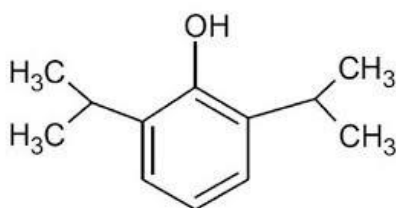


Figure (VIII): Chemical structure of Propofol.

Brand name: Dipriva - **The Use:** Induction of anesthesia, Maintenance of anesthesia during total intravenous anesthesia, for total control intravenous anesthesia (T.C.I.), Sedation in intensive care, Sedation during endoscopies, Sedation for dental anesthesia - **Contraindications:** It is contraindicated in people who are allergic to Propofol or any other component of the treatment. It is also contraindicated in patients who are allergic to eggs or their derivatives, soybeans or its products, and in cases where general anesthesia is contraindicated. - **The side effect:** Pain on injection, hypotension, transient apnea, postoperative fever, nausea, vomiting, and headache to a small number of patients, sexual disinhibition on recovery, rarely discoloration of urine, rarely epileptiform (Brosnan et al., 2011). **Etomidate:** It is a short-acting intravenous anesthetic agent used for induction of general anesthesia and sedation for short procedures such as reduction of dislocated joints, endotracheal intubation, cardioversion, and electroconvulsive therapy.

- **Chemical formula:** C₁₄H₁₆N₂O₂

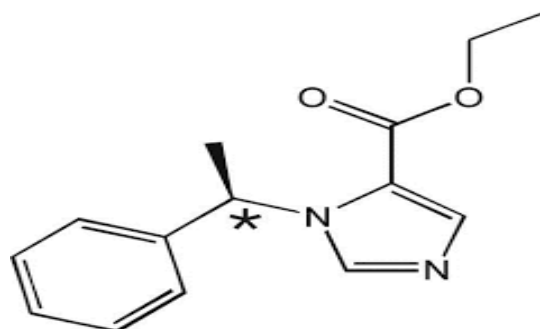


Figure (IX): Chemical structure of Etomidate.

Brand name: Amidated - **The Use:** Mainly used for induction of anesthesia in patients with compromised CVS. **Contraindications:** Etomidate is contraindicated in people who suffer from hypersensitivity (anaphylaxis) to the drug, or one of the substances used in its manufacture. - **The side effects:** pain at injection, Nausea, and vomiting, Suppression of synthesis of cortisol. **Opioids:** Opioids are drugs with morphine-like action, the opioids are classified into: A- Pure opioids agonists 1 – Morphine: A pain reliever belonging to a group of treatments called opioids or narcotic treatments, used in the treatment of moderate to severe pain, and works by inhibiting pain receptors in the central nervous system. Treatment is available in a variety of pharmaceutical forms (tablets, rectal suppositories, injections, etc.), fastacting pharmaceutical forms are available for use when needed, and long-acting forms are taken daily. The treatment may cause a kind of addiction if it is used in large doses and/or for long periods. - **Chemical formula:** C₁₇H₁₉NO₃

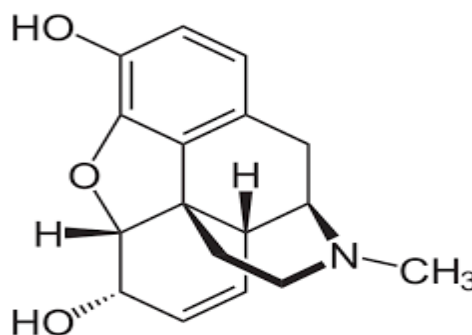


Figure (X): Chemical structure of Morphine.

Trade name: Mscontin, Oramorph, Sevredol (Morphine as a sulfate - Route of administration: Oral, IV, IM, Epidural, intrathecal - Duration of action: 3-4hrs - The Use: It is used as an analgesic in the treatment of moderate to severe pain, acute or chronic, such as pain associated with myocardial infarction, and helps relieve slip or shortness of breath associated with some heart or lung diseases. Contraindications: Not to be used in: Patients who have shown hypersensitivity to the treatment or any of its components, severe respiratory depression, severe bronchial asthma, presence or suspicion of ileal paralysis. The Side effects: Itchy skin, skin redness, vomiting and nausea, stomach pain, constipation, headache, drowsiness, dizziness, trouble sleeping.

Pethidine: An analgesic, belonging to the group of opioid analgesics, acts as an opioid receptor agonist, blocking the transmission of pain pathways ascending to the brain, preventing moderate to severe pain. Chemical formula $C_{15}H_{21}NO_2$

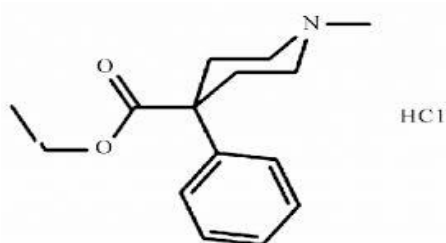


Figure (XI): Chemical structure of Pethidine

Trade name: Demerol. - Route of administration: IV, IM, Epidural, intrathecal - Duration of action: 3-4 hrs. - The Use: It is used to relieve moderate to severe pain, including post-operative pain and labor pain. Contraindications: Hypersensitivity to any of the components. - The side effects: Nausea, vomiting, anorexia, headache, dizziness, dry mouth, reduce sexual desire.

Fentanyl: A pain reliever belonging to a group of treatments called opioids or narcotic treatments, used in the treatment of moderate to severe pain, as it works by inhibiting pain receptors in the central nervous system. - Chemical formula: $C_{22}H_{28}N_2O$

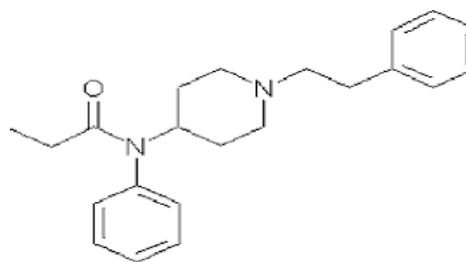


Figure (XII): Chemical structure of Fentanyl.

Trading name: Sublimaze. - Route of administration: IV, Epidural, intrathecal, Transdermal 20 - Duration of action: 30-40min - The Use: The treatment is used in Pain reliever and anesthetic as an adjunct to anesthesia before various surgeries Contraindications: Contraindicated in: Patients who have shown hypersensitivity to the treatment or to any of its components, cases of increased intracranial pressure (high pressure of fluid within the skull, which may result from various causes such as trauma or some types of treatment), having disease or severe depression of the system respiratory conditions Ileoparalysis (paralysis of the intestines), severe liver or kidney failure, It is also not recommended for use in pregnant women for long periods. - The side effects: Nausea, vomiting, constipation, rotary, drowsiness, headache tiredness or fatigue, swelling in the extremities (hands and feet).

Tramadol: It is a synthetic pain reliever similar to opioid analgesics, such as morphine. It works in the brain to change the nature of the body's response to pain. Tramadol binds to opiate receptors in the brain that are important for transmitting the feeling of pain from all parts of the body to the brain. - Chemical formula: $C_{16}H_{25}NO_2$

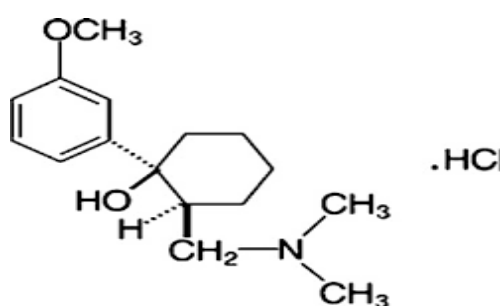


Figure (XIII): Chemical structure of Tramadol.

Trade name: Noblegan, Tiparol, Topalgic, Tridolan, Tramal, Ultram, Xprime. - Route of administration: IV, IM, Oral. - Duration of action: 3-4 hrs - The Use: Tramadol is used to relieve moderate to severe pain, and tramadol extended-release tablets are also used to relieve moderate to severe chronic pain in adults who need continuous long-term treatment. - Contraindications: Tramadol should not be used to treat pain in children younger than 12 years old, or to treat pain caused by surgery to remove the tonsils or adenoids in children under 18, In addition, the use of tramadol is not suitable for some people, so it is advisable to inform the doctor before starting taking the drug if the person has one of the following: Allergic reaction to tramadol or any other medicines, head injury, addiction to alcohol or illegal recreational drugs, breathing difficulties, kidney or liver problems. - The side effects: Feeling dizzy, drowsy, tired, or weak, constipation, dry mouth, upset stomach, or vomiting, headache, Itching, redness of the face, neck, arms, and sometimes the upper chest, sleep problems difficulty, severe muscle stiffness, Seizures, difficulty swallowing or breathing, irritability or hallucinations, nausea, vomiting, irregular menstruation, decreased sexual desire, changes in heart rate, unconsciousness (Liu et al., 2008 ; Kaye and Theaker, 2001).

Partial Opioid agonists:

1- Nalbuphine: This medication contains Nalbuphine, an analgesic of the Phenanthrene series, which is an opiate pain medication. An opiate is sometimes called a narcotic. It is more effective in women than men, and can even increase pain in men - Chemical formula: C₂₁H₂₇NO₄

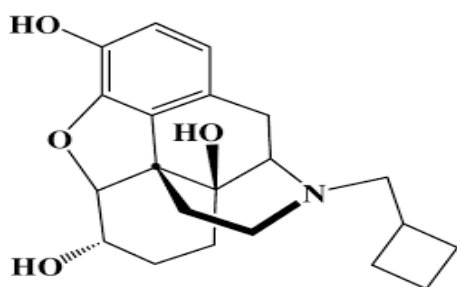


Figure (XIV): Chemical structure of Nalbuphine

Trade name: Alampophene, Nalvin, nalbin, Nalofen, naloxime - Route of administration: IV, IM, subcutaneous injection - The use: This medication is used to relieve moderate to severe pain, preoperative and postoperative pain relief. - Contraindications: Hypersensitivity to any of the components of this medicine, asthma and breathing problems, intestinal obstruction. - The side effects: Dizziness or lightheadedness, drowsiness, sweating, vomiting.

Pure Opioid antagonist

1- Naloxone: It is an antidote used to neutralize the toxic effect of certain types of substances. - Chemical formula: C₁₉H₂₁NO₄

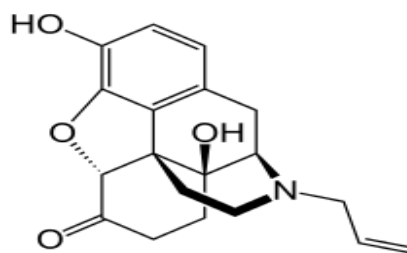


Figure (XV): Chemical structure of Naloxone

Trade name: Narcon - Route of administration: IV, IM - The use: Treatment of Opioid overdose - Contraindications: Patients who have shown hypersensitivity to the treatment or any other component of the treatment. - The side effects: Increased blood pressure, musculoskeletal pain, headache, dry nose, skin dryness, toothache, constipation, ventricular fibrillation, shortness of breath, lung edema.

The blood pressure (BP): Blood pressure (BP) is the pressure of circulating blood against the walls of blood vessels. Most of this pressure results from the heart pumping blood through the circulatory system. Blood pressure is usually expressed in terms of systolic pressure (maximum pressure during one heartbeat) over diastolic pressure (minimum pressure between two heartbeats) in the cardiac cycle. It is measured in millimeters of mercury (mmHg) above the surrounding atmospheric pressure. Blood pressure is one of the vital signs—together with respiratory rate, heart rate, oxygen saturation, and body temperature—that healthcare professionals use in evaluating a patient's health. Normal resting blood pressure, in an adult is approximately 120 millimeters of mercury (16 kPa) systolic over 80 millimeters of mercury (11 kPa) diastolic, denoted as "120/80 mmHg" (American Heart Association, 2017).

The Body temperature: Normal human body temperature is the typical temperature range found in humans. The normal human body temperature range is typically stated as 36.5–37 °C (97.7– 98.6 °F) (Hutchison et al., 2008), An individual's body temperature typically changes by about 0.5 °C (0.9 °F) between its highest and lowest points each day (Longo et al., 2011). Human body temperature varies, It depends on gender (Kelly, 2007), age (Protsiv et al., 2020), time of day, exertion level (Kelly, 2006), health status (such as illness and

menstruation), what part of the body the measurement is taken at, state of consciousness (waking, sleeping, sedated), and emotions. Body temperature is kept in the normal range by thermoregulation, in which adjustment of temperature is triggered by the central nervous system. 25 There are different methods used for measuring temperature. The temperature reading depends on which part of the body is being measured.

Table (I): Temperature by measurement technique (Sund-Levander et al., 2002).

Method	Women	Men
Oral	33.2-38.1 °C (91.8-100.6°F)	35.7-37.7 °C (96.3-99.9°F)
Rectal	36.8-37.1 °C (98.2-98.8°F)	36.7-37.5 °C (98.1-99.5°F)
Tympanic	35.7-37.8 °C (96.3-100.0°F)	35.5-37.8 °C (95.9-100..°F)

Heart rate: Heart rate is the speed of the heartbeat measured by the number of contractions (beats) of the heart per minute (bpm). The American Heart Association states the normal resting adult human heart rate is 60–100 bpm. Tachycardia is a high heart rate, defined as above 100 bpm at rest. Bradycardia is a low heart rate, defined as below 60 bpm at rest. When the heart is not beating in a regular pattern, this is referred to as an arrhythmia. Abnormalities of heart rate sometimes indicate disease (Fuster et al., 2001). That many factors can influence heart rate, including age, fitness and activity levels, being a smoker, having cardiovascular disease, high cholesterol, or diabetes, air temperature, body position (standing up or lying down, for example), emotions, body size, medications (Zhang & Zhang, 2009). Although there's a wide range of normal, an unusually high or low heart rate may indicate an underlying problem.

Red blood cells (RBCs): Also referred to as red cells erythroid cells or erythrocytes, are the most common type of blood cell. The function of the red cell is to carry oxygen from the lungs to all the body tissues and to carry carbon dioxide, a waste product of metabolism, to the lungs, where it is excreted. (Kumar et al., 2017; Guyton, 2000). The cytoplasm of erythrocytes is rich in hemoglobin, an iron-containing biomolecule that can bind oxygen and is responsible for the red color of the cells and the blood (D'Alessandro et al., 2017). In humans, mature red blood cells are flexible and oval biconcave disks. They lack a cell nucleus and most organelles, to accommodate maximum space for hemoglobin. Approximately 2.4 million new erythrocytes are produced per second in human adults (Sackmann, 1995). The red cell develops in the bone marrow, the average red cell in humans lives 100–120 days (Blom, 2003), nearly half of the blood's volume (40 - 45%) is red blood cells (Snyder and Sheafor,

1999). Women usually have a lower RBC count than men, and the level of red blood cells tends to decrease with age. A normal RBC count would be: Men: 4.7 to 6.1 million cells per microlitre (cells/mcL), Women: 4.2 to 5.4 million cells/mcL

White Blood Cell (WBCs): White blood cells (WBCs), also called leukocytes that exist in the blood lymphatic system and tissues are an important part of the body defense system they help protect against infections and also have a role in inflammation and allergic reactions (Maton et al., 1997). All white blood cells are produced from stem cells in the bone marrow. White blood cells include Neutrophils, Eosinophils, Basophils, Lymphocytes, and Monocytes (LaFleur-Brooks, 2008). The normal range of WBCs between 4,000 to 11,000 cells per microliter of blood.

Platelet: Platelets or thrombocytes are small colorless cell fragments in the blood, platelet has a role in forming clots and stops or prevents bleeding (Laki, 1972), their number ranges from 150,000 to 450,000 thousand plates per cubic mm.

Hemoglobin (Hgb): Hemoglobin is a substance in red blood cells that (Hemoglobin is what gives red blood cells their color), is the iron-containing oxygen-transport metalloprotein in the red blood cells (Maton et al., 1993). Normal hemoglobin levels for men are between 14.0 and 17.5 grams per deciliter (gm/dL); for women, it is between 12.3 and 15.3 gm/dL.

Urea: Urea is a natural product of nitrogen and protein metabolism and is predominantly found in urine and animal waste, Amino acids derived from the breakdown of protein are delaminated to produce ammonia. Ammonia is then converted to urea via liver enzymes.

Creatinine: Creatine is a molecule that's produced in the body from amino acids. It's primarily made in the liver and to a lesser extent in the kidneys and pancreas. The primary benefit of creatine is an improvement in strength and power output. Serum creatinine range is 0.6–1.3 mg/dL (53–115 µmol/L).[4] Measuring serum creatinine is the most commonly used indicator of renal function (Taylor, 1989).

Sodium: Sodium is an electrolyte, and it helps regulate the amount of water that's in and around the cells. Normal serum sodium levels are between approximately 135 and 145 milliequivalents per liter (mEq/L) (Jameson et al., 2016).

Potassium: Potassium is an important mineral that functions as an electrolyte. It helps regulate fluid balance, nerve signals, and muscle contractions. 29 Roughly 98% of the potassium in the body is found in cells. Of this, 80% is found in muscle cells, while the other 20% can be found in bones, liver, and red blood cells. Normal potassium levels are between 3.5 and 5.0 mmol/L (3.5 and 5.0 mEq/L). Our study aimed at

evaluating the effect of anesthetics on the biological, hematological, and biochemical parameters of individuals.

B. Objectives of the study

The study aims to achieve the following: 1- Evaluation of the effect of anesthetic use on some hematological parameters of patients undergoing surgery. 2- Evaluation of the effect of anesthetic used on the biochemical parameters of patients undergoing surgical procedures. 3- Assessing the extent of change in vital signs in patients before and after using anesthetic in surgical operations.

II. METHODS AND MATERIALS

A. Area of the study:

The study was conducted in Misurata city.

B. Study samples:

The study included 50 patients, the number of males were 28, while the number of females was 22, their ages ranged from one to 75 years, and the average age was 38 years, and their weight ranged from 8 - 90 Kilogram (Kg), in the period from May to August 2021. All patients were admitted to hospitals (Misurata Medical Center, Al-Hikma Hospital) to undergo surgery.

C. Study samples collection

A questionnaire was filled out including age, gender, weight, type of surgery, and type of anesthetic. As shown in the questionnaire form in Appendix No (1). Blood pressure, heart rate, and body temperature were measured before the surgery, and blood samples were taken from veins from all patients before anesthesia was administered and before surgery (which is considered a control reading) in sterilized vacuum tubes, and divided into two tubes: the first does not contain any anticoagulant material for biochemical analyzes, and the second contains EDTA anti-coagulant for blood cell analyze.

D. Study samples tests:

D.1 Vital Signs:

The blood pressure (BP) of all patients in this study was measured before the anesthesia for the surgery, and it was re-measured after the surgery to note any change in the results. The patient's body temperature was also measured before and after anesthesia, heart rate was also measured before and after the anesthesia.

D.2 Blood signs

A- Complete Blood Count test (CBC): includes total white blood cell count (WBCs), total red blood cell count (RBCs), platelet count, and Hemoglobin concentration (HbG). B- The biochemical blood analyzes included: - Kidney function tests (KFT): Urea. Creatinine, - Blood Ions tests: Sodium (Na), Potassium (K), After that, the patients have given anesthesia (General Anesthetic or spinal Anesthetic) and then they were operated on. After the surgery, blood pressure, heart rate, and body temperature were measured for each patient subject to this study, and venous blood samples were taken from all patients in two tubes, one containing an anticoagulant substance and the other not containing an anticoagulant substance, to study any change of the CBC or biochemical markers in the blood.

E. Statistical analysis

The data were statistically analyzed to calculate the probability value (P value), the arithmetic mean, and the standard deviation of the values recorded in the study using the statistical program (SPSS 26), with the minimum significance level set at P- value < 0.05.

III. RESULTS AND DISCUSSION

The study included 50 cases of people undergoing anesthesia for surgical operations, their ages between one to 75 years. Statistical analyzes were conducted for a range of factors that could have a role in the results of this study, such as gender, age, weight, type of anesthetic substance.

A. The gender of the study samples:

The study samples were divided according to gender into two groups: - The first group: included the Females: the number of females was 22 (44%) from the total study samples. - The second group included the males: the number of males was 28 (56%) from the total study samples, as in table (II)

Table (II): The gender of the study samples

	Frequency	Percentage
Male	28	56%
Female	22	44%
Total	50	100.0

B. The ages of study samples:

The study samples were divided according to age into five groups: - The first group: The age group less than 15 years, included 7 (14%) from total study samples. - The second group: The age group from 16-30 years, which included 17 (34%) from total study samples. - The third group: the age group from 31-45 years, including 13 (26%) from total study samples. - The fourth group: included the age group from 46-60 years, included 6 (12%) from total study samples. - The fifth group: included the age group greater than 61 years, and included 7 (14%) from total study samples, as in figure (XVI).

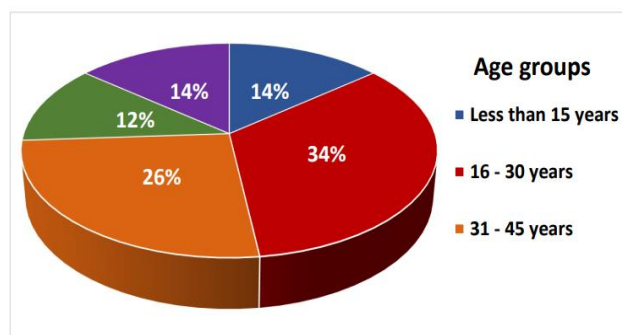


Figure (XVI): The ages of the study samples.

C. The weights of the study samples:

The weights of the study samples ranged from 8 to 90 kg. According to the weight, the study samples were divided into five groups as follows: - The first group: The category less than 20 kg, it included 3 (6%) from the total study samples. 14% 34% 26% 12% 14% Age groups Less than 15 years 16 - 30 years 31 - 45 years 39 - The second group: the weight category from 20-40 kg, including 4 (8%) from the total study samples. - The third group: weight category 41-60 kg, which included 9 (18%) from the total study samples. - Fourth group: weight category 61-80 Kg, which included 28 (56%) from the total study samples. - The fifth group: included the weight

category above 81 kg, and included 6 (12%) from the total study samples, as shown in table (III).

Table (III): The weights of the study samples

Weight	Frequency	Percentage
Less than 20 Kg	3	6%
20 – 40 Kg	4	8%
41 – 60 Kg	9	18%
61 – 80 Kg	28	56%
More than 81 Kg	6	12%
Total	50	100.0%

The types of anesthetics used in the study: 6% 8% 18% 56% 12% The Weights Less than 20 Kg 20 – 40 Kg 41 – 60 Kg 61 – 80 Kg More than 81 Kg 40 The anesthetics used in this study were divided into two groups of anesthetics: - General anesthetics: include 34 (68%) of total study samples. - Spinal anesthetics: included 16 (32%) of total the study samples, as shown in figure (XVII).

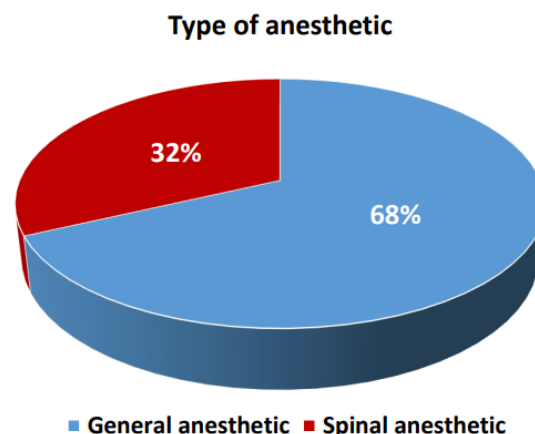


Figure (XVII): The types of anesthetics used in the study

The relationship between blood pressure and anesthetics: The blood pressure was measured before and after the operation, The statistical results showed that there were statistically significant differences in the average blood pressure before and after the anesthesia operation, where the probability value was) P-Value 0.000), Where the blood pressure decreased after the operation, as shown in the table (IV).

Table (IV): *The relationship between blood pressure and anesthetics.*

Blood pressure	Number	Arithmetic mean	Standard error	standard deviation	P-value
Before	50	125.72	2.52	17.80	0.000
After	50	117.50	2.13	15.03	

The relationship between body temperature and anesthetics: The temperature was measured before and after the anesthesia operation, The statistical results showed that there were no significant differences in the average body temperature before and after the anesthesia operation, where the probability value was ($P = 0.163$), Where the temperature increased after the operation, as shown in Figure (XIX).

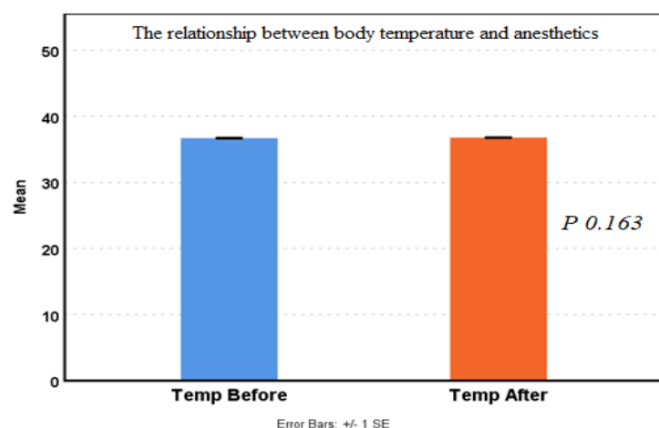


Figure (XIX): *The relationship between body temperature and anesthetics.*

The relationship between heart rate and anesthetics: The heart rate was measured before and after the anesthesia operation, The statistical results showed were significant differences in the heart rate before and after the anesthesia operation, where the probability value was ($P = 0.033$) Where the heart rate decreased after the operation, as shown in the table (V).

Table (V): *The relationship between heart rate and anesthetics*

Heart rate	Number	Arithmetic mean	Standard error	standard deviation	P-value
Before	50	97.28	2.85	20.12	0.033
After	50	92.58	1.82	12.84	

The relationship between Hemoglobin concentration and anesthetics: The hemoglobin concentration measured before and after the anesthesia, the statistical results showed were significant differences in the average hemoglobin concentration before and after the anesthesia operation, where the probability value was ($P = 0.000$), Where the hemoglobin concentration decreased after the operation, as shown in the figure (XXI)

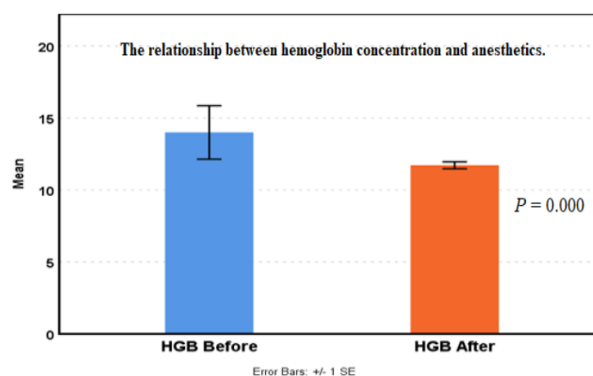


Figure (XXI): *The relationship between hemoglobin concentration and anesthetics.*

The relationship between White blood cells (WBCs) and anesthetics: The white blood cell count was measured in both cases before and after the anesthesia, and the statistical results showed that there were no significant differences in the average WBC before and after the anesthesia, where the probability value was ($P = 0.199$), as shown in the table (VI).

Table (VI): *The relationship between White blood cells (WBCs) and anesthetics*

White blood cells	Number	Arithmetic mean	Standard error	standard deviation	P-value
Before	50	8.71	0.57	4.04	0.199
After	50	8.79	0.56	3.94	

The relationship between Red blood cells (RBCs) and anesthetics: The red blood cell count measured before and after the anesthesia, the statistical results showed that there were no significant differences in the average RBCs before and after the anesthesia, where the probability value was ($P = 0.952$), as shown in the figure (XXII).

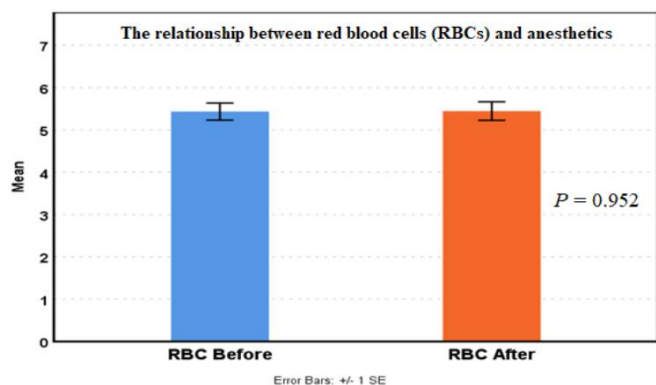


Figure (XXII): The relationship red blood cells (RBCs) and anesthetics

The relationship between Platelets count and anesthetics: The platelet count was measured before and after the anesthesia, The statistical results showed that there were significant differences in the average platelets before and after the anesthesia operation, where the probability value was ($P = 0.082$), as shown in the table (VII)

Table (VII): The relationship between Platelets and anesthetics.

Platelets Count	Number	Arithmetic mean	Standard error	standard deviation	P-value
Before	50	220.86	13.53	95.66	0.082
After	50	219.08	15.75	111.40	

The relationship between Urea and anesthetics: The statistical results showed that there were no significant differences in the Urea before and after the anesthesia operation, where the probability value was ($P = 0.732$), as shown in figure (XIV).

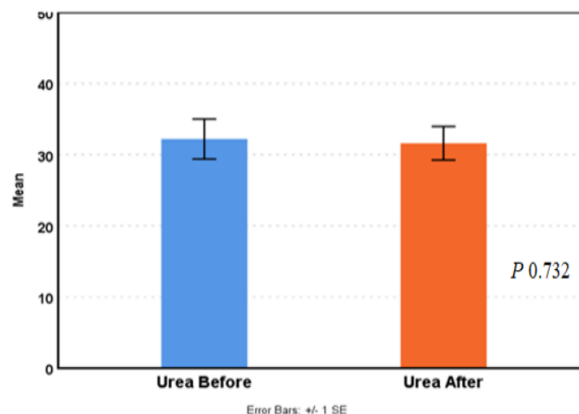


Figure (XIV): The relationship between Urea and anesthetics

The relationship between Creatinine and anesthetics: The statistical results showed that there were significant differences in the creatinine before and after the anesthesia operation, where the probability value was ($P = 0.021$), as shown in table (VIII)

Table (VIII): The relationship between Creatinine and anesthetics

Cr.	Number	Arithmetic mean	Standard error	standard deviation	P value
Before	50	0.634	0.045	0.315	0.021
After	50	0.568	0.046	0.327	

The relationship between Sodium and anesthetics: The statistical results showed that there were no significant differences in sodium before and after the anesthesia operation, where the probability value was ($P = 0.225$), as shown in the figure (XV).

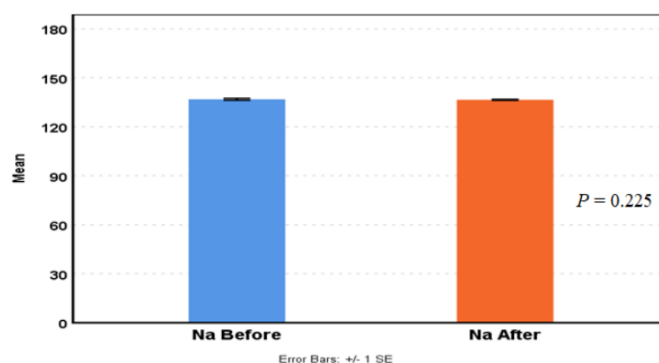


Figure (XV): The relationship between Sodium and anesthetics

The relationship between Potassium and anesthetics: The potassium concentration measured before and after the anesthesia, the statistic results showed that there were no significant differences in the potassium concentration before and after the anesthesia operation, where the probability value was $P = 0.870$), As shown in the table (IX) .

Table (IX): *The relationship between Potassium and anesthetics.*

Potassium	Number	Arithmetic mean	Standard error	standard deviation	P-value
Before	50	3.91	0.11	0.80	0.870
After	50	3.95	0.15	1.09	

The study was conducted to evaluate the effect of the use of some anesthetics on some vital, hematological and biochemical parameters of patients undergoing surgical operations in Misurata, Libya. - Regarding the vital (biological) factors: Body temperature, blood pressure, and heart rate were measured for all patients participating in this study, and the results of the study showed that there were statistically significant differences (P value = 0.000) in blood pressure and heart rate ($P = 0.033$), like blood pressure and heart rate decreased after surgery, the study agreed the study of Diaa and Al Omari in 2015, which showed that blood pressure was affected after anesthesia and had distinct differences at the statistical level. - As for the temperature, it was not affected after anesthesia, as no significant statistical differences ($P = 0.163$) appeared with the body temperature before and after anesthesia. The results of our study agreed with the study Diaa and Al Omari in 2015. - Regarding hematological factors: The statistical results of the complete blood count (CBC) analysis showed that there were significant differences between hemoglobin concentration and the administration of anesthetics ($P = 0.000$), and this agreed with a study conducted in 2015 on horses (Diaa and Al Omari, 2015). As for the number of white blood cells, the results of the study showed that the rate of white blood cells was not significantly affected and was within the normal limits, and no statistically significant differences appeared at the statistical level ($P = 0.199$). The results of our study agree with the study of Diaa, and Al Omari, 2015. - About red blood cells, the study showed that they were not significantly affected after anesthesia and were within the normal limits, and there were no statistically significant differences at the statistical level ($P = 0.952$). A study conducted by Diaa and Al Omari in 2015 showed that the number of erythrocytes decreased significantly at a statistical level ($P \leq 0.05$). The study also showed that platelets were affected morally after anesthesia, where significant differences appeared ($P = 0.082$), and this did not agree with a study conducted by Diaa and Al Omari,

which showed that platelets are not significantly affected by giving the drug, and no significant differences at the statistical level ($P \leq 0.05$). As for biochemical factors: The study showed that urea, sodium, and potassium were not affected and were within the normal limits, and there were no significant differences between urea and the administration of anesthetic ($P = 0.732$), as well as sodium ($P = 0.225$), and potassium ($P = 0.870$), and this did not agree with a study conducted Diaa and Al Omari showed that the element sodium and potassium decreased after anesthesia and it was a significant decrease at the statistical level ($P \leq 0.05$). As for creatinine, there were statistical differences ($P = 0.021$), and this did not agree with the study of Nouri Zia and Azzam al-Omari, which showed that creatine remained within the normal limits and no significant differences.

IV. CONCLUSION

Anesthetics have little effect on some vital signs such as blood pressure and heart rate. Anesthetics also affect the concentration of hemoglobin and platelets, while they do not effect on body temperature, white blood cell count, red blood cells, urea, potassium, and sodium.

REFERENCES

- [1] 1. Albozachri, J. M. K., Al-faris, A. A., & Majeed, S. K. (2012). Effect of use two general anesthetic regimes on some clinical and biochemical parameters in donkeys. Kufa Journal For Veterinary Medical Sciences, 3(2). 149-151.
- [2] American Heart Association. (22 Aug 2017). All About Heart Rate (Pulse).
- [3] Becker, D. E., & Rosenberg, M. (2008). Nitrous oxide and the inhalation anesthetics. Anesthesia progress, 55(4), 124-131.
- [4] Beilin, B., Martin, F. C., Shavit, Y., Gale, R. P., & Liebeskind, J. C. (1989). Suppression of natural killer cell activity by high-dose narcotic anesthesia in rats. Brain, behavior, and immunity, 3(2), 129-137.
- [5] Beilin, B., Shavit, Y., Cohn, S., & Kedar, E. (1992). Narcotic-induced suppression of natural killer cell activity in ventilated and nonventilated rats. Clinical immunology and immunopathology, 64(2), 173-176.
- [6] Blom, J. A. (2003). Monitoring of respiration and circulation. CRC Press. 27.
- [7] 7. Brosnan, R. J., Steffey, E. P., Escobar, A., Palazoglu, M., & Fiehn, O. (2011). Anesthetic induction with guaifenesin and propofol in adult horses. American journal of veterinary research, 72(12), 1569-1575.
- [8] D'Alessandro, A.; Dzieciatkowska, M.; Nemkov, T. & Hansen, K. C. (2017). Red blood cell proteomics update: is there more to discover?. Blood Transfusion, 15(2), 182.
- [9] De Hert, S., & Moerman, A. (2015). Sevoflurane. F1000Research,4(F1000 Faculty Rev).61

- [10] Diaa, A. N. and Al Omari, A. (2015). Effects of premedication and inhalation anaesthesia on the hematological and biochemical parameters in the Horses. *The Iraqi Journal of Veterinary Medicine*, 39(2), 55- 60.
- [11] Eger 2nd, E. I. (1984). The pharmacology of isoflurane. *British journal of anaesthesia*, 56, 71S-99S.
- [12] Fuster, Valentin; Wayne, Alexander R.; O'Rourke, Robert A. (2001). *Hurst's The Heart* (10th).
- [13] Guyton, A. C. (2000). Transport of oxygen and carbon dioxide in the blood and body fluids. *Textbook of medical physiology*.
- [14] Hanley, C. S., Clyde, V. L., Wallace, R. S., Paul-Murphy, J., Patterson, T. A., Keuler, N. S., & Sladky, K. K. (2010). Effects of anesthesia and surgery on serial blood gas values and lactate concentrations in yellow perch (*Perca flavescens*), walleye pike (*Sander vitreus*), and koi (*Cyprinus carpio*). *Journal of the American Veterinary Medical Association*, 236(10), 1104-1108.
- [15] Hutchison, J. S., Ward, R. E., Lacroix, J., Hébert, P. C., Barnes, M. A., Bohn, D. J., ... & Skippen, P. W. (2008). Hypothermia therapy after traumatic brain injury in children. *New England Journal of Medicine*, 358(23), 2447-2456.
- [16] Kaye, K., and Theaker, N. (2001). *TRAMADOL: A Position Statement of the NSW Therapeutic Assessment Group Inc. An Initiative of NSW Clinical Pharmacologists & Pharmacists-Funded by the NSW Department of Health*. Sydney. 1-15.
- [17] Kelly, G. S. (2007). Body temperature variability (Part 2): masking influences of body temperature variability and a review of body temperature variability in disease. *Alternative medicine review*, 12(1).62
- [18] Kelly, G. (2006). Body temperature variability (Part 1): a review of the history of body temperature and its variability due to site selection, biological rhythms, fitness, and aging. *Alternative medicine review*, 11(4).
- [19] Kumar, V.; Abbas, A. K., & Aster, J. C. (2017). *Robbins basic pathology e-book*. Elsevier Health Sciences.
- [20] Laki, K. (1972). Our ancient heritage in blood clotting and some of its consequences. *Annals of the New York Academy of Sciences*, 202(1), 297-307.
- [21] .LaFleur-Brooks M (2008). *Exploring Medical Language: A Student Directed Approach* (7th ed.). St. Louis, Missouri, US: Mosby Elsevier.398
- [22] Liu, Y. M., Zhu, S. M., Wang, K. R., Feng, Z. Y., & Chen, Q. L. (2008). Effect of tramadol on immune responses and nociceptive thresholds in a rat model of incisional pain. *Journal of Zhejiang University SCIENCE B*, 9(11), 895-902.
- [23] Longo, D. L., Jameson, J. L., & Kaspe, D. (2011). *Harrison's Principles of Internal Medicine: Volume 2*. Macgraw-Hill.
- [24] Malamed, S. F. (2004). *Handbook of local anesthesia*. Elsevier Health Sciences.
- [25] Maton D, Hopkins J, McLaughlin CW, Johnson S, Warner MQ, LaHart D, Wright JD, Kulkarni DV (1997). *Human Biology and Health*. Englewood Cliffs, New Jersey, US: Prentice Hall. ISBN 0-13-981176-1.
- [26] Maton, Anthea; Jean Hopkins; Charles William McLaughlin; Susan Johnson; Maryanna Quon Warner; David LaHart; Jill D. Wright (1993). *Human Biology and Health*. Englewood Cliffs, New Jersey, US: Prentice Hall. ISBN 978-0-13-981176-0.63
- [27] Miller, K. W. (2002). The nature of sites of general anaesthetic action. *British journal of anesthesia*, 89(1), 17-31.
- [28] Patel, S. S., & Goa, K. L. (1995). Desflurane. *Drugs*, 50(4), 742-767.
- [29] Patel, S. S., & Goa, K. L. (1996). Sevoflurane. *Drugs*, 51(4), 658-700.
- [30] Protsiv, M., Ley, C., Lankester, J., Hastie, T., & Parsonnet, J. (2020). Decreasing human body temperature in the United States since the industrial revolution. *Elife*, 9, e49555.
- [31] Robinson, D. H., & Toledo, A. H. (2012). Historical development of modern anesthesia. *Journal of Investigative Surgery*, 25(3), 141-149.
- [32] Sackmann, Erich. (1995). Biological membranes architecture and function. *Structure and Dynamics of Membranes*, 1, 1-63.
- [33] Salo, M. (1992). Effects of anaesthesia and surgery on the immune response. *Acta Anaesthesiologica Scandinavica*, 36(3), 201-220.
- [34] Snyder, G. K., & Sheafor, B. A. (1999). Red blood cells: centerpiece in the evolution of the vertebrate circulatory system. *American zoologist*, 39(2), 189-198.
- [35] Taylor, E. H. (1989). *Clinical Chemistry*. New York: John Wiley and Sons. pp. 4, 58–62.
- [36] Törneke, K., Bergström, U., & Neil, A. (2003). Interactions of xylazine and detomidine with α_2 - adrenoreceptors in brain tissue from cattle, swine, and rats. *Journal of veterinary pharmacology and therapeutics*, 26(3), 205-211.
- [37] Zhang, G. Q., & Zhang, W. (2009). Heart rate, lifespan, and mortality risk. *Ageing research reviews*, 8(1), 52-60