Regional Anesthesia in Trauma

Essay

Submitted for partial fulfillment of Master Degree in Anesthesia ICU and Pain Management

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2012

Abstract:

Regional anesthesia is considered one of those modalities for pain management either alone or in combination with general anesthesia or even be used for postoperative pain management. In this essay we discuss the history of regional anesthesia application and its importance in wars, also we discuss in another chapter the advantages and disadvantages of application of regional anesthesia in trauma patients. Finally we discuss different techniques of regional anesthesia application and different methods of identification of nerves to be blocked including the usage of ultrasound which is so promising in this field.

Key word:

Regional Anesthesia- *Physiology of trauma and pain- Nerve Blocks*-5-HT.

Acknowledgment

First and foremost thanks and praise Allah most gracious, most merciful, by whose abundant grace, this work has come to life.

I would like to express my deep gratitude, thanks and respect to our eminent *Prof. Dr Mohamed Hafez* for granting me the privilege of working under his supervision, kind help, indispensable advice and encouragement from the start of this work.

No words can be sufficient to express my deep gratitude, admire and appreciation to *Prof. Dr Tarek Ali Roshdy* and *Dr Sherief Mohamed Soaida* for their great support, valuable advice and continuous encouragement .Their sincere effort and help will never be forgotten.

Last but not by any means least I would like to express my warm gratitude to my parents, my wife and my sister for their kindness, unfailing support and much needed encouragement.

CONTENTS

LIST OF TABLES

Page

LIST OF FIGURES

Page

LIST OF ABBREVIATIONS

5-HT	*Serotonin*
ACL	*Anterior Cruciate Ligament*
ACTH	*Adrenocorticotrophic hormone*
BC	*Before Christ*
CCK	*Cholecystokinin*
CGRP	*Calcitonin gene–related peptide*
CNS	*Central Nervous System*
COX-2	*Cyclooxygenase-2*
CPNB	*Continuous peripheral nerve block*
CRP	*C-reactive protein*
DRG	*Dorsal Root Ganglia*
DVT	*Deep Venous Thrombosis*
ECG	*Electrocardiogram*
ED	*Emergency department*
ELH	*Lutinizing Hormone*
ENK	*Enkephalin*

FSH	*Follicle stimulating hormone*
GABA	*Gamma-aminobutyric acid*
h	*Hours*
ICU	*Intensive Care Unit*
IL-1/6/8	*Interleukin 1/6/8*
IV	*Intravenous*
LFC	*Lateral Femoral Cutaneous*
m/s	*Meters per second*
mA	*Milliampere*
mL	*Milliliter*
NMDA	*N –methyl-D-aspartate*
NSAIDS	*Non Steroidal Anti-inflammatory Drugs*
PCA	*Patient Controlled Analgesia*
PGE	*Prostaglandin*
PLP	*Phnatom Limb Pain*
PNBs	*Peripheral Nerve Blocks*
PNS	*Periphera Nerve Stimulation*
PSNB	*Parasacral Nerve Block*

Sp	*Substance P*
T_3	*Tri-iodothyronine*
T_4	*Thyroxin*
TAP	*Transverses Abdominus Plane*
TBI	*Traumatic Brain Injury*
THA	*Total Hip Arthroplasty*
TKA	*Total Knee Arthroplasty*
TNF-α	*Tumor necrosis factor-α*
TSH	*Thyroid stimulating hormone*
US	*Ultrasound*
WDR	*Wide Dynamic Range*
WHO	*World Health Organization*
WRAMC	*The Walter Reed Army Medical Center*

Aim of the work

The aim of this work is to review the importance of application of different modalities of regional anesthesia in trauma patients, also to mention its complications and contraindications. And the techniques used for its application.

Traffic accidents kill more than a million people every year worldwide and injure or permanently disable millions more. The Middle East region ranks second highest in terms of road fatalities, according to the WHO, with Egypt alone suffering more than 7,000 deaths annually. **(Jon Mark Hirshon, 2010)**

Anesthesia for trauma patients is one of the greatest challenges in anesthesia. Critically ill patients whose history, status, and injuries are not well known must be treated. The pain management of a trauma patient, with their specific physical and emotional experience, imposes additional demands to anesthesiologists and critical care specialists.

Many factors in the management of the trauma victim (hemodynamic fluctuations, respiratory depression, and level of consciousness) contribute to the difficulties faced in the pain control of these patients. In addition, the consequences of inadequate pain management after an injury are more than just psychological.

Anesthesiologists have particular skills in the provision of pain relief and this is of vital importance in the early and consequent management of the injured patient. Analgesia should be regarded as part of the resuscitation process because it not only brings pain relief, but also improves hemodynamic stability resulting in improved organ and tissue perfusion. **(Laura C. & Marina V., 2009)**

Acute pain is known to potentiate the physiologic stress response to trauma. The tissue damage and the dynamic of the central nervous system can engage mechanisms and create chronic pain problems that outlast the period of healing. **(Wu C.L. et al, 2006)**

The role of regional anesthesia in the trauma patient is both complex and controversial. The decision-making is complex, because trauma patients may present with a spectrum of injuries and in various degrees of shock. Accordingly, simple rules cannot be applied to all patients. Use of regional anesthesia in the trauma patient is controversial, because initial historical reports of spinal anesthesia use in acute trauma predictably resulted in catastrophe, and several common trauma-related conditions constitute either absolute or relative contraindications to regional anesthesia (e.g., full stomach, hemodynamic compromise, unstable/unclear cervical, thoracic or lumbar spine, compartment syndrome of lower extremities, etc.). **(Bernstein RL et al, 2000)**

In cases of multiple trauma involving head or torso injuries where airway management and controlled ventilation are critical, general anesthesia is clearly a superior choice. However, there are many other trauma scenarios, for which regional anesthesia provides substantial benefit as the primary anesthetic, an adjunct to general anesthesia, or analgesia postoperatively.

Trained anesthesiologists can expeditiously administer regional anesthesia. The quick onset and lack of sophisticated equipment for delivery allow use in distant and austere environments (so long as appropriate monitoring and resuscitation equipment are available). Additionally, regional anesthetics allow the patient to remain awake and alert, facilitating ongoing evaluation of mental status. **(Wildsmith J., 2003)**

Mechanisms and demographics in trauma:

Injury is the leading cause of death in people aged between 1 and 44 years in the United States and a leading cause of death worldwide. It can be defined as "physical damage to the structure or function of the body, caused by an acute exchange of energy (mechanical, chemical, thermal, radioactive, or biological) that exceeds the body's tolerance". **(Fingerhut LA & Warner M, 1996)**

- ***Types of trauma:***

1. **UNINTENTIONAL MOTOR VEHICLE TRAFFIC-RELATED INJURY MECHANISMS:**

Half of deaths are related to head-on impact, and the rest involve side impact (25%), rear impact (less than 10%), and rollover. **(Pedro B.et al, 2008)**

2. **PEDESTRIAN VEHICLE COLLISION:**

Adult pedestrian injury typically involves three impacts:

- Impact with the lower limbs as the impacting vehicle brakes and decelerates, lowering the front of the vehicle.
- Impact with the hood of the vehicle as the casualty is thrown forward, causing head and chest injuries.
- Impact with the ground, commonly causes head injury.

3. FALLS:

Falls involve a sudden deceleration in the vertical plane. The magnitude of injury depends on height, transference and absorption of energy, and orientation of the victim. Falls of 8 to 10 meters (25–30 feet, three stories in a building) are fatal in 50 percent of victims. **(Pedro B. et al, 2008)**

4. FIRE AND BURN DEATHS:

Deaths from fires and burns are the fifth most common cause of unintentional injury deaths in the United States. Most victims of fires die from smoke or toxic gases and not from burns. Smoking is the leading cause of fire-related deaths, and cooking is the primary cause of residential fires. **(Ahrens M., 2003)**

5. PENETRATING TRAUMA MECHANISMS :

- **Low-Energy Transfer Sharp Implements**

Knives/ Swords: The main issue to appreciate when managing knife wounds is that tissue is elastic. The dimensions of the observed wound in a patient may not relate to the weapon used. A knife assailant may turn the blade in the target's body, causing increased damage as structures are deliberately cut.

- **Projectiles**

Arrows: In general, injuries from arrows can be considered as "low-energy transfer" wounds and the area of injury is closely related to the arrow trajectory.

Bullets: The injury produced by a bullet is the result of a complex interaction between the bullet and tissue.

- **Explosive Munitions' Injury**

  Blast injury has been classified as follows:

  - **Primary**: due to the actions of the blast or overpressure wave. This can completely disintegrate a casualty.
  - **Secondary**: due to fragments projected by the energy of the explosion. Fragments can be "natural" from the random fragmentation of the bomb's components, or "preformed" from notched wire, metal balls, or squares packed into the bomb. These cause multiple penetrating injuries.
  - **Tertiary**: due to the casualty being thrown/displaced by the explosion or injured due to structural collapse. This is generally "blunt" injury.
  - **Quaternary**: all other effects, including fires from the explosive components or from ignited fuel, toxic effects of fumes, and exacerbation of medical conditions. **(Pedro B. et al, 2008)**