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Benefits Of Ketamine Versus Propofol in Acute Traumatic Brain Injuries with Elevated Intracranial Pressure

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ABSTRACT

Ketamine has been used as an anesthetic drug over 65 years. Ketamine is a potent analagesic with dissciative and sedative properties. In early research Ketamine should not be administered to those with acute brain injuries. In(1970) early studies suggesting that it could increases the pressure inside the skull known as intracrainal pressure and thus a decreases in cereberal perfusion and reduce oxygen supply to the demaged cerebal cortex. Current studies has shown that ketamine directly evaluating the effect of patient on ICP in traumatic brain injury I.e decreases ICP. Ketamine now considerd one of the best drug because provide excellent hemodynomic support. In comparison, the use of propofol for induction is one of the most popular agent used for induction of anesthesia and long term sedation. Propofol, a short acting intravenous anesthetic , has been utilized in the management of craniocerebral injury for induction,maintains, and sedation during surgery. Propofol also reduces cerebal blood flow, maintain rate for oxygen and decreased intracranial pressure. This literature review identify the benefits and safety of cerebral hemodynomic use of Ketamine versus propofol for induction in the adult population showing for decompressive craniotomy.There were currently researches , studies and reviews is 31 give conclusion /outcome is decreased ICP ,hemodynamic control , and ideal pain control.

Appear use of ketamine does not increase ICP and maybe just producing the desired result for those showing with TBI.

INTRODUCTION

In the united states , around 1.7 million people suffer atraumatic brain injury with different group of ages. During hospitalization, it is most important to maintain cerebral hemodynamics to provide better patient recovery . But annually cases of TBI 5.48 million people.More than half of people related death, leading causes of disability and death inyoung adults in the united states. It is identify that period of elevated ICP combined with hypotension leads to anincreases in mortality and poor recovery forpatient with a traumatic brain injury .A traumatic brain injury can result fromboth a closed head injury or a penetrating injury by foreign objects such as bullets.

Traumatic brain injuries are categorized as either primary or secondary injuries primarybrain injury occurs during the initial insult(trauma) and result from displacement of the physical structure of the brain. It occurs at the moment of , trauma and includes contusion , demage to bloodvessels, and axonal shearing ,in which the axons of neurons are stretched and torn also meanings may be damaged in the primary injury, and neurons may die. Primary injury divided into 4 categories:

1:Subdural hematoma

2:epidural hemotama

3:intraparenchymal hemorrhage

4: non focal , most common type subderalhemotoma causes highest risk of motality.

A. Increases ICP(sum ,amount of blood collects from the veins between the skull and brain ,lead increases ICP.)

B. Compression cerebal blood flow. Secondary injury is an indirect result of the injury. It results from processors initiated by the trauma, It occursin the hours and days fallowing the primary injury. And play a large role in the brain demage and death that results from TBI.

Secondary injury can result from complicationsof the injury. These include ischemia hypotension, cerebral edema , changes inthe blood flow in the brain and raised intracranial pressure of ICP gets too high,it can lead to deadly brain herniation.

Glasgow coma scale was originally, developed to help determine the severity of a coma or dysfunction fallowing a traumaticinjury, but can be useful for any condition leading to impaired consciousness. Today it is used for many conditions including:

1:infection

2:brain abscess

3:non traumatic coma

4:overdose

5:poisoning

Glasgow coma scale (GCS) was first created by Graham Teasdale and Bryen Jennett 1974. It is a clinical scale to assesses coma severity based on eye- opening responses, motor abilities and verbal abilities

Monro- Kelly doctrine states that the brain is not compressible and enclosed in the cranium so any increase in intracranial volumewill cause on increases in ICP Intracranial space is made

up of four compartments:

Blood, brain, intra cellular water and CSF.Anyone increase , must be a decreasesother factor to maintain a constant ICP.

Elevated ICP pressure increased 20-25mmHg Normal ICP in adult is 5-15 mmHg. Measured within the lateral ventricle or the subarachnoid space over the cerebral cortex. If ICP increases 20-25mmHg then treatmentis necessary to maintain appropriate cerebral hemodynamics and patient safety.

Surgical option for TBIS depend on the type of injury because treatment generallyconsists of surgery or a drain to decrease pressure on the brain. Generally surgery involves interventions such as craniotomy Many induction agents can be used to help maintain cerebral hemodynamics . Currenty, most common choice of anesthesia is propofol used in various procedural sedations . It directly interacting with GABA-A receptors . When these receptors are activated increase in transmembrane chloride conductance leading to hyper polarization in inhibition of the post synaptic cell membrane.

Advantages:-Rapid onset of action, minimul neurological effect, return of consciousness rapidly .

Disadvantages: dose dependent, whichcause decrease in cerebral blood flow and metabolic gate of oxygen.

Ketamine help to relieve these hemodynomic effect because ketamine provide excellent hemodynamic stability and respiratory status (minimul effect occur).

Ketamine interacts with N-METHYL – D ASPARTATE (NMDA) RECEPTORS,opoid receptors, monoominergic receptors , muscarine receptors and voltage sensitive ca ion channels. Unlike other general anesthetic agents , ketamine does not interact with GABAA receptors. It is a rapid – acting general anesthesia and NMDA antagonist used for induction of anesthesia diagnostic and surgical producers typically in combination with a muscle relaxant . In early research 1970s and 1980s stated that ketamine could lead to increase ICP , so ketamine has been per pituated as a poor choice for anesthesia but after FDA (FOOD AND DRUG ADMINISTRATION) (Ketamine hydrochloride) has been approved for general anesthesia either alone are in combination with other medications it increase in cerebro spinal fluidpressure. It should be used with extremecaution in patient with preanesthetic elevated cerebrospinal fluid pressure.

METHOD

Keywords: intracranial pressure , hemodynamic stability , cerebral blood perfusion , traumatic brain injury . Further search term utilized were “propofol +ICP”. “KETOFOL; ketamine +traumatic brain injury and propofol + traumatic brain injury”.

Severe common themes were noted in thearticles about ketamine and it is safety for those with elevated ICP states it could further increases ICP and not safe for anesthetic option in early research , but later articles stated safe for anesthetic option and neuroprotection when use ketamine, as well as provide excellent stability for cerebral hemodynamics other articles identify benefits of ketofol. Both have benifical properties to an anesthetics with one agent not being preferable over the other .these discussions will be explored below:

Ketamine use can cause deleteriouseffect on cerebral hemodynamics

The study by Shapiro (1972) conducted assessed the effect of IV ketamine on ICP . There were 7 patients assessed , and they either received ketamine for induction or a neuro diagonotic procedure . ICP was measured through a ventricluostomy catheter in the lateral cerebral ventrical , arterial bp measured with brochial cough or radial arterial catherter . Patient received 2 mg / kg =I V ketamine . Were 4 patients identify to increase ICP after use the ketamine noted , these patients had abnormal CSF flow in this group , the ICP average 13 -63 mmHg

Increase cerebral blood flow andminimum increase in systemic arterial pressure in comparison

Increased ICP was followed by a rapid redaction after delivering STP and if needed hyperventilation through / via mask . Overall , acute of ICP / hypertension with ketamine usewas high in patient who found with intrcronialpathologics and caution its use in this population.

Ketamine may be benifical for cerebral Hemodynamics

A systemic review by cohen E tal.2014 to add up a large population of 953 patients across different studies . Studies include collected data on the effect of IV ketamine as a bolus versus infusion in those who had previously been intubated/were being intubated in data collection . Primary outcome assessed was cerebral perfusion pressure . Secondary outcome measure include neurological , motality and ICU longerstay . He conclude that the collected data suggests that ketamine does not adversely effect ICP , cpp , neurological outcomes , when compared to other anesthetic agents

Bourgoin et al . (2005) conducted a randomized study on 30 patients with severe head injury (post resuscitation) . patients were randomized deliver to either sufentanil+midazolam, as ketamine +Midozolam or sedation in ICU . ventricular catheter is used to measure ICP and arterial line, CPP was also obtained but now a days use to assess sediation level by EEG.The authors found ICP and CPP values didn‟t verysignificantly between the 2 groups . When given double doses of the medication , no major alteration of

any cerebral hemodynamics compound when baseline values . conclusion of this group infusion of ketamine + midazolam was just as sufficient as compared sufentanil + midozolam controlling ICP / CPP in patient with TBI.

PROPOFOL USE AND EFFECT ON CEREBRAL HEMODYNAMICS:-

There were some articles present that noted that propofol had a deleterious effect on ICP , favored use in critical neuro anesthesia (rapid recovery), offered some neuro protection its ability to decreases cerebral metabolic rate of or oxygen (CMRo2) decreases ICP and cerebral blood flow which improved operating conditions .

Further articles show / identify propofol benefits in anesthesia for maintaining CPP and ICP in those with acute TBI when used as an induction agent .

Combination of ketamine and propofol (ketofol): BY RCTS (Randomized controlled trials) many benefits identify when combination of propofol and ketamine and administration of ketofol infusion and ketamine and propofol use of consecutively on induction analyze will following articles . A randomized , double – blind trial was conduct by Andolfatto(2012) to identify the use of ketofol versus propofol is emergencyprocedural sediation .

Ketofol was mixed 1:1 ratio i.e 10 mg ml ketamine and 10 mg/ml propofol in a 20 ml of syringe , ketofol received a dose of 0.375 mg/kg patients include 284., per group present 142 patients. Outcomes being identifying number and preposition of the patient who experienced and adverse respiratory event;secondary outcomes :sedation consistency,effory time , induction time , and adverse events . It was identify both groups had achieved deep sedaition timing/ number of doses required . Ketofol led to a more consistent depth of anesthesia , and propofol to a higher incidence of intreprocedural agitation during recovery phase ketofol group agation was more common . Overall , limitation of the study include difference in clinicians „options“ . in the phase of a possible adverse event , as different clinicians may have intervented a different thresholds . For this literature review , this study does not have any corelation to critical neuroanesthesia and ICP / CPP management Cloclusively. He started stated that sediation depth was more consistent with ketofol and there was no adverse event increase for propcedural sedation (ketofol vs propofol procedural sedation).

A randomized , double –blind study was conducted by Sharma – (2016). The author to assess major difference when a patient deliver a ketofol or fentanyl-propofol(fentofol)infusion for a short orthopedic procedure . Study group100 patients total , all with American society ofanesthesiology (ASA) Scores 1 or 2

Hemodynamics were measured for the patients that deliver either ketofol as fentofol for induction and then maintains with the infusion as well. It was identify in ketofol group significant increase in PULSE RATE ,SBP, DBP, decrease in intraoperatively and postoperatively the total amount of propofol consumed was lower in the ketofol group assessed no major adverse effect in the ketofol group .In comparison fentofol

group had a significantly prolonged recovery time . conclusion , it stated that a total IV anesthetic (TIVA) of ketofal compared to fentofol providedbetter sedation , analgasie, better recovery in patient and stability of hemodynamics.

DISCUSSION

After conductin this literaturereview it appears that combination of ketamine and propofol as an infusion . Ketofol is the most ideal option for patients found with acute TBI . A few aspects conducting by RCTS show ketofol infusionssuch as more stable hemodynamics decreased consumptionof propofol and narcotics , and better recovery outcome.

Using ketofol has been noted to provideadequate sedation and analgesia , also decreased total doses of each drug.

CONCLUSION

Great advancements has been made in the understanding of ketamine‟s safety for patients with traumatic brain injury. Many articles do not assess any of the cerebral protective properties of ketamine instead , ketamine is not addresses contraindicated in TBI patients elevated ICP , But recently research ketamine decrease ICP and increase cerebral perfusion overall , ketamine and propofol is anestheticagent . There has been great advancement and understanding for those patient who found with acute TBI . IN early studies 1970s-1980s appears when use ketamine for patients with acute TBI increased ICP and decrease cerebral perfusion . But after later research identify when we born ketamine and propofol appropriately , anesthesia providerscan provide safe , stable hemodymic , maintain cerebral perfusion and overall most impact that will benefits a patient‟s longterm recovery and prevent mortality.

Conclusion of this paper is to identify use of ketamine and propofol , as anesthetic agents for these presenting with severe TBI . Assessing ketamine and propofol‟s overall effects on ICP CPP and CBF and hemodynamic stability . The purpose of the literature review is to determine if either medication provide better pain control , maintains of hemodynamics stability , and overall patient recovery improved .

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