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A Review and Comparison on the Effectiveness and Safety Profile of Using Ketamine and Propofol for Upper Gastrointestinal Endoscopy: A Literature Review

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Author's contribution

The sole author designed, analysed, interpreted and prepared the manuscript.

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Review Article

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ABSTRACT

This review reflects the usage of ketamine and propofol for endoscopy. It also works to compare whether either of these agents has a stronger action alone as compared to their combined action. The gastrointestinal system is one of the most problematic systems of the human body. It can be divided into two regions. These are upper gastrointestinal tract and lower intestinal tract. The diseases and conditions involving the gastrointestinal tract may arise anywhere throughout its entire length. Gastrointestinal Endoscopy is one of the most sought methods for the diagnosis and treatment of several conditions involving the gastrointestinal tract.

Endoscopy is a very helpful diagnostic and therapeutic procedure that has been indicated for several patients. Endoscopy is an invasive procedure; it is required for the patient to be sedated during the process to ensure a pain-free experience.

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1. INTRODUCTION

The gastrointestinal system is one of the most problematic systems of the human body. It is considered to be problematic in the sense that the majority of people experience symptoms related to disturbances in their gastrointestinal tract. For convenience, it is better to divide them into two regions - those concerning the upper gastrointestinal tract and those involving the lower intestinal tract. The upper gastrointestinal tract comprises the esophagus, stomach, gall bladder, pancreas, liver, and all the surrounding muscles and vasculature that revolve around the swelling and the initiation of the digestion of food. The lower gastrointestinal tract, on the other hand, revolves around the intestines and the anus, and the rectum, all of which are involved with the digestion and the defection of the excreta [1].

The diseases and conditions involving the gastrointestinal tract may arise anywhere throughout its entire length. However, for simplifying the process of diagnosis and management, it is better to refer to the symptoms as those belonging to the upper or lower gastrointestinal tract. The diagnostic and management protocols are different for each region as well [2].

It is observed that annually, upper gastrointestinal symptoms are the very prevalent ones that render a doctor's appointment by the people. Among these symptoms, dyspepsia is one of the most common causes. Whether benign or malignant, all types of gastrointestinal diseases require prompt diagnostic measures so that appropriate management plans could be started without wasting any time.

Gastrointestinal Endoscopy is one of the most sought methods for the diagnosis and treatment of several conditions involving the gastrointestinal tract [3]. It is a very prevalent and commonly performed diagnostic procedure that helps yield important information regarding the status of the gastrointestinal tract [4].

Over the past few years, the trend of opting for endoscopy over radiology has increased significantly. The obvious reason for this could be the better result profile and much better diagnostic help with the former instead of the latter. Some serious illnesses such as upper gastrointestinal bleeding, gastritis, esophagitis, Mallory Weiss tears, and arteriovenous malformations have been found to get diagnosed earlier and in a much better way through endoscopy [5]. This has only added to the helpful profile for this diagnostic and therapeutic modality. On the other hand, endoscopy has also been found to be a helpful therapeutic modality in some cases such as the removal of foreign objects, and repair of lacerations, the incision and drainage of abscesses, or tube thoracostomy [6].

However, the concern of this review article revolves around the usage of an appropriate anesthetic agent for the purpose of endoscopy. It is obvious that an invasive and somewhat painful procedure like an endoscopy would require some sort of sedative or numbing agent to help the patient sit through the procedure with ease and comfort. The PSA (Procedural Sedation and Anesthesia) requires the usage of an appropriate drug that helps the patient get sedated, with or without the usage of analgesia.

This review reflects the usage of ketamine and propofol for endoscopy. It also works to compare whether either of these agents has a stronger action alone as compared to their combined action.

2. THE TREND OF USING KETAMINE AND PROPOFOL FOR UPPER GASTROINTESTINAL TRACT ENDOSCOPY

It has been established that endoscopy for any suspected pathology or disease must only be conferred upon the patient when the physician deems it absolutely necessary for the confirmed diagnosis. The reason for this is the invasiveness and the cost of the procedure, which is otherwise more costly than the traditional diagnostic methods.

In any clinical setting, it has been recommended that the endoscopy of the upper gastrointestinal tract must only be done when there is an evaluated or established abdominal symptom that persists despite therapy with the appropriately targeted drugs, or when there is an abdominal symptom that seems to be alarming, given the present condition of the patient. In all such patients, it is necessary to counsel them in a way that the patients and their attendants are well-aware and educated about the benefits and risks of the procedure [7].

Persistent bouts of vomiting, progressive dysphagia in the elderly, melena or black-colored stools, unexplained weight loss, and the presence of a chronic abdominal disease that is causing problems just recently, upper GI endoscopy works as a very authentic tool. The prevalence and popularity of upper GI endoscopy have increased a lot over the past few years. It is widely available everywhere, in both rural and urban settings, and from private clinics to large tertiary-care hospitals. [8].

Before endoscopy begins, the patient is made to lie in a position that is comfortable enough for the doctor to carry out their relevant examinations properly. Next, there is an urgent need to sedate the patient so that they are asleep throughout the procedure and do not feel the invasiveness and pain from this procedure. It is understood that an invasive procedure like endoscopy is bound to be painful for the patient, with its tolerance being different for different people. Whether the sedative agent is given with or without appropriate analgesia is highly dependent upon the doctor's decision, the anesthetist's discretion, and any underlying factors of the patient that might be brought into consideration before taking that step.

The two most commonly used anesthetizing sedative agents during endoscopy are ketamine and propofol. Both have their individual mechanisms of action, although there have been a significant number of studies that revolve around their combined action, which is, again, considered to be more effective and safe when done on patients [9].

For the sake of convenience and better understanding, both these agents have been reviewed separately, and then their combined action is studied in the later sections.

2.1 Ketamine

Ketamine is an intravenous anesthetic agent that is majorly used for short-term surgical procedures. It is often used in procedures that do not require the relaxed state of skeletal muscles [10]. When required, ketamine could also be used as a combination agent in general anesthesia. The efficacy of ketamine has been found to be great and very helpful in effectively carrying out procedures that need to be done in a short amount of time. Some procedures that are done with the help of ketamine include the reduction of fractures and dislocations, endoscopy, the repair of wounds in agitated or non-cooperative patients, and others [11].

Ketamine has been approved for usage in both children and adults, and it has also been seen that children metabolize ketamine faster than adult patients. As a result, the dosage of ketamine is higher in kids and lower in adults due to its metabolizing effects.

The action of ketamine takes place through inhibition of the N-methyl-D-aspartic acid (NMDA) receptors. Ketamine is an NMDA receptor antagonist. NMDA receptors are a type of glutamate receptor involved in the transmission of excitatory signals in the brain. By blocking NMDA receptors, ketamine reduces the activity of glutamate, which is an important neurotransmitter involved in learning, memory, and various cognitive processes. This blockade of NMDA receptors contributes to ketamine's anesthetic and dissociative effects. Moreover, ketamine also affects other neurotransmitter systems, such as the opioid, serotonin, and dopamine systems. It can lead to increased release of neurotransmitters like dopamine and serotonin in certain brain regions. This way, the neurotoxicity in the brain (that occurs as a response to glutamate) is reduced. This helps in producing a trance-like state of sensory isolation in the brain, which results from the dissociation of the cortical and limbic systems. Apart from this action, ketamine is also helpful in producing an adequate amount of analgesia and amnesia in the patient [12].

The duration of action of ketamine in adult patients is between 5 to 10 minutes. Although not uncommon, there are a few adverse effects associated with the usage of ketamine, and these include transient respiratory depression, laryngospasm, ataxia, agitation, excessive salivation or drooling from the mouth, etc. In some vulnerable cases, it might even cause an increase in cardiac output and the resultant increase in blood pressure in some patients [13].

When talking specifically about the usage of ketamine in endoscopy, it is an established fact that using ketamine could be an appropriate choice for conducting endoscopy in patients for the purpose of diagnosis and treatment. Ketamine, due to its special effects, such as the reduction of pain, particularly neuropathic pain, is considered to be of great help in inducing both analgesia and sedation in the selected patients.

In a study conducted to find out the effect of ketamine on pediatric patients undergoing gastro-enteric endoscopy, it was found that

combing an oral dose of ketamine with an intravenous bolus of midazolam was a great option for inducing sedation and analgesia in infants and children. The only drawback associated with the usage of this combination was the vomiting that was duly reported due to the usage of oral ketamine [14].

Another study revealed that the usage of ketamine along with the sublingual dosage of alprazolam was another helpful option for conducting endoscopy in patients. From these evaluations, it could be a very good hypothesis to state that using a carefully calculated dosage of ketamine in combination with some other agents has been found to be of great help in inducing anesthesia and analgesia in patients undergoing endoscopy for their gastrointestinal symptoms [15].

2.2 Propofol

Propofol is an intravenous anesthetic agent that is also used for various short-term and long-term surgical procedures. It is given both as an intravenous or bolus formulation and at other times, is used in combination with other agents for better effects [16].

Propofol is seen to exert its mechanism of action by depressing the central nervous system through the transmission of gamma-aminobutyric acid (GABA). By doing so, it ensures strong anesthetic properties. However, in comparison to ketamine, it does not have potent analgesic properties, which is also one of the reasons why it is often used in combination more than being used alone, but it does have excellent amnesic properties [17]. Propofol enhances the inhibitory effects of the neurotransmitter GABA in the brain. GABA is the primary inhibitory neurotransmitter, and its binding to GABA receptors leads to a decrease in neuronal activity, resulting in sedation, relaxation, and anesthetic effects. Propofol increases the activity of GABA receptors, which leads to hyperpolarization of neurons and a reduction in their firing rate. By enhancing the activity of GABA-A receptors, propofol suppresses the transmission of signals within the brain. This suppression of neural activity results in the loss of consciousness, reduced awareness of sensory stimuli, and a state of deep sedation or anesthesia.

Over the past few years, the usage of propofol has also increased, especially in emergency settings. Its onset of action takes about a minute and the duration lasts for about six minutes, thus making it an ultra short-acting drug. As far as the adverse events linked with the usage of propofol are concerned, it can cause respiratory depression, venous irritation, and arterial hypotension [18].

However, one advantage that propofol has over ketamine is that it does not cause any significant bouts of vomiting in patients who have been administered with it. There have also been cases where propofol has been used as an anti-emetic agent.

As far as the link between propofol and endoscopy is considered, there have been various studies that have advocated for the usage of propofol and ketamine together for endoscopic procedures.

3. COMBINATION OF KETAMINE AND PROPOFOL FOR CONDUCTING UPPER GASTROINTESTINAL ENDOSCOPY

Using ketamine and propofol together for endoscopy has been around since the late ‘90s. Since both are similarly acting agents, it has been recommended that both these agents should be used in their respective ‘low’ doses instead of their full doses when being used in combination. This results in better action and decreases the rates of complications and toxicities that might otherwise arise due to the increased dosage of either of these agents alone [19].

In a study carried out to determine the efficacy of ketofol, it was seen that the action of ketamine and propofol is found to be complementary to each other when used in combination, which proves the fact that their combination is indeed beneficial to be used. This also helps improve patient satisfaction rates, since it helps them have the optimal experience due to its administration [20].

Ketofol is found to be as effective as the combination of propofol and fentanyl, which is also used for the same purposes. Ketofol also ensures better hemodynamic stability in the patients who experience this formulation.

All in all, it could be assumed that since endoscopy is an invasive procedure and because it revolves around a detailed examination, sometimes even a diagnostic approach, it is better to use a combination of two agents, such as propofol and ketamine that could help induce both sedation and analgesia in the

patients. The idea is to let the patient undergo a completely painless and comfortable experience so that their other symptoms could be checked and balanced accordingly [21]. Moreover, there are no significant side effects whatsoever that might occur in the patient post-procedure. In case the patient experiences any sort of vomiting, nausea, or sickness, then it is evident that the patient might have experienced it due to the administration of ketamine. However, this effect occurs only in some of the patients. In the rest of the patients, the effect of propofol is enough ot take care of these symptoms.

So, it could be safely said that instead of using either of these agents alone for anesthetic purposes, it is better to use them both in a combination of calculated dosages to help maximize their effects. They are both safe to use and could help achieve the desired results to sedate the patient and keep them pain-free during surgical procedures and endoscopies.

4. CONCLUSION

Endoscopy is a very helpful diagnostic and therapeutic procedure that has been indicated for several patients. Endoscopy for the upper gastrointestinal tract is done for patients who have been experiencing symptoms in relation to their acidity, reflux, or gastritis issues. In such patients, it becomes necessary to evaluate and confirm the suspected diagnosis, if there is any. Since endoscopy is an invasive procedure, it is required for the patient to be sedated during the process to ensure a pain-free experience. Many anesthetic agents have been declared safe for this practice, however, ketamine and propofol are two commonly used agents that have higher efficacy and safety rates than other agents. Using both of them in combination is much better and has better results than either of them being used alone.

CONSENT AND ETHICAL APPROVAL

It is not applicable.

COMPETING INTERESTS

Author has declared that no competing interests exist.

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