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Utilization of Ketamine, Midazolam and Low Dose Propofol for Conscious Sedation; A Safe and Effective Alternative

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Abstract

Conscious sedation is defined as a technique of administering sedatives or dissociative agents with or without analgesics to induce a state that allows the patient to tolerate unpleasant procedures while maintaining cardio respiratory function. Conscious sedation requires careful titration of the agents involved in conjunction with continuous monitoring of the patient. Over the last fifteen years we have transitioned from the use of two agents; Ketamine and Midazolam to the use of three agents; Ketamine, Midazolam and low dose Propofol for conscious sedation. The inclusion of low dose Propofol infusion (25 mcg/kg/min) has resulted in a significant decreased recovery time and nausea. In an attempt to understand the etiology of the enhanced recovery we reviewed the quantity of the agents used during sedation in this study.

Keywords: Ketamine; Midazolam; Conscious Sedation

Introduction

Our initial sedation protocol included the use of Ketamine and Midazolam [1-7]. Ketamine is a neuroleptic agent that may be administered intravenously or intramuscularly. We prefer intravenous administration to provide a more predictable neurotropic profile. We administered Ketamine in 10 mg increments. Ketamine increases cardiac output, causes increased heart rate, increases respirations and central venous pressure. Ketamine may induce psychomimetic reactions and has been reported to be associated in emergence reaction in 30% of patients [1-4]. In order to decrease the occurrence of adverse emergence reactions we have incorporated the use of Midazolam with Ketamine. Midazolam reduces anxiety, produces sleepiness, muscle relaxation and short term memory loss. Midazolam is commonly utilized for procedural sedation because of its rapid half-life which improves safety relative to Valium. Side effects of Midazolam include low blood pressure and decreased respirations thus making it an ideal agent to utilize in conjunction with Ketamine. Propofol is a sedative and hypnotic which has a risk of cardiovascular depression and respiratory depression. As a result of these various effects the combined use of Ketamine with Midazolam and/or Propofol has several obvious advantages based on their respective pharmacological effects [8-10]. In this report we compare the dosage requirements of Ketamine and Midazolam when used alone versus the dosage required of Ketamine and Midazolam when combined with low dose Propofol for breast augmentation.

Materials and Methods

Between 1996 and 2015 we have performed over 1,000 breast augmentation procedures for cosmetic purposes. The annual number of procedures is approximately 100 cases. We reviewed 50 sequential cases in 1998 versus 50 sequential cases in 2015 to determine the amounts of anesthetic agents utilized and to assess variations in respiratory depression, nausea and rate of emergence. All agents were administered intravenously. Pulse oximetry and capnography was utilized in all cases to monitor respiratory status. Midazolam was administered in 1.0 mg increments with Ketamine administered in 10 mg increments.

Results

In the patients who were administered Ketamine and Midazolam the average amounts of drugs utilized per case was Ketamine 0.14 +/- 0.08 mg/kg mean +/- standard deviation and Midazolam 0.24 +/- 0.05 mg/kg to achieve appropriate conscious sedation levels (Table 1). For patients in

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Table 1: Amount of Agents Utilized During Sedation.

	Midazolam Use	Ketamine Use	Propofol Use
Midazolam Ketamine Group	0.24 +/- 0.05 mg/kg	0.14 +/- 0.08 mg/kg	———
Midazolam Ketamine Propofol Group	0.014 +/- 0.04 mg/kg	0.07 +/- 0.06 mg/kg	25 Mcg/kg/min

whom the combination of the three agents was utilized the dosages were Ketamine 0.07 +/- 0.06 mg/kg, Midazolam 0.014 +/- 0.04 mg/kg, Propofol 25 was infused at a rate of mcg/kg/min (Table 1). Both groups also had 0.01 mg/kg of Atropine administered I.V. prior to sedation. Emergence reactions were not observed in either group in any patient. Ketamine use was reduced by 51% ($P \leq 0.05$) and Midazolam use was reduced by 41% ($P \leq 0.05$) with the addition of low dose Propofol. There was no incidence of respiratory depression (a change of +/- 5% from baseline levels) in either group. Nausea resulted in 4 patients with 2 agents and 2 patients in the group with 3 agents which were significant ($P \leq 0.05$).

Conclusion

The dosage of Ketamine and Midazolam required for conscious sedation was significantly reduced by combining the usage with Propofol. Significant regional and national variations in the use of sedation and analgesic practice exist, and as a result the utilization of multiple agents to take advantage of the synergistic effects of the various pharmacologic agents is common. All patients were able to walk to the bathroom with assistance within 20 minutes of termination of the procedure. In our cases the rapid recovery of our patients with our sedation protocol was important. The rapidity of recovery speaks to the skill and experience of administration in addition to the pharmacokinetics of the agents employed. While the use of Ketamine and Propofol or Midazolam and Ketamine for sedation has been extensively described the utilization of Ketamine, Midazolam and Propofol with appropriate monitoring results in significant reduction of the dosage requirements of the agents during surgery and therefore enhanced safety. We demonstrate that Ketamine and Midazolam are effective options for conscious sedation. We further conclude that low dose Propofol in conjunction with Ketamine and Midazolam is a safe and effective method for conscious sedation and addition of low dose Propofol results in a significant reduction of the amount of Ketamine and Midazolam required obtaining conscious sedation. Further the incorporation of Propofol reduces the incidence of nausea following procedures. We attribute the decrease in nausea to the decrease in Ketamine when Propofol is incorporated.

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