Journal of Pain Research

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CASE REPORT

Ketofol for monitored anesthesia care in shoulder arthroscopy and labral repair: a case report

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Abstract: A 21-year-old male (body mass index: 28.3) with a history of asthma and reactive airway disease since childhood underwent left shoulder arthroscopy and labral repair surgery under monitored anesthesia care. Because the procedure was performed in the beach chair position, access to the patient's airway was limited throughout. To avoid general anesthesia and to limit potential complications associated with monitored anesthesia care, a ketofol admixture was used. This case demonstrates that, in conjunction with regional anesthesia, ketofol may be an acceptable alternative to propofol for maintenance in outpatient orthopedic procedures.

Keywords: ketamine, propofol, ketofol, sedation, case report

Introduction

Propofol and ketamine are commonly used in the emergency department for procedural sedation and analgesia.[1] Propofol is a nonbarbiturate sedative-hypnotic agent used as a general anesthetic in both operating rooms and intensive care units (ICUs). It is favored in the outpatient setting because of its rapid onset and short duration of action. Propofol possesses amnesic, anticonvulsant, and antiemetic properties;[2] however, its use results in a dose-dependent reduction in mean arterial pressure (MAP) and respiratory drive.[3] When used for deep sedation, propofol may have antinociceptive properties through suppression of cortical activity and responsiveness.[4] However, propofol's inability to reliably provide adequate analgesia prevents it from being the sole anesthetic for any stimulating procedure. Ketamine is a dissociative analgesic and anesthetic believed to produce its effects primarily through noncompetitive antagonism of the *N*-methyl-D-aspartate receptor.[5] Like propofol, ketamine provides dose-dependent amnesia, but it has the additional benefit of bronchodilation with maintenance of spontaneous respirations and airway reflexes at clinical doses. Ketamine's disadvantages include sympathomimetic reactions, aggravation of laryngospasm, increased intracranial pressures, and worsened postoperative nausea and vomiting (PONV).[3] At higher doses or with rapid infusions, ketamine can paradoxically induce respiratory depression, but this effect is uncommon with levels used for sedation. As a result of its structural resemblance to phencyclidine, ketamine is classically associated with a frightening emergence reaction that is believed to occur more commonly in adults.[6] Both midazolam and propofol are used to prevent and treat this terrifying phenomenon.

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http://dx.doi.org/10.2147/JPR.S108503

Ketofol is a moniker for ketamine and propofol administered either separately or in combination as a single-syringe admixture.[7] Ketofol is hypothesized to be the ideal agent for sedation and analgesia, because the need for lower doses of each agent, combined with the opposing actions of both, decreases the incidence of dose-related side effects.[3] This combination has been recently popularized in the emergency department setting for short procedures; however, optimal doses of each agent for maintenance anesthesia have not been fully elucidated. Compared to propofol alone, ketofol is believed to significantly decrease the incidences of hypotension, bradycardia, and respiratory depression while simultaneously improving analgesia. The concerns of increased PONV, muscle rigidity, and psychotomimetic reactions do not seem to increase significantly when ketamine is used adjunctively as in ketofol.[8]

Currently, only a handful of reports[1,9] have evaluated the use of ketofol for procedural sedation and analgesia, but none have reported its use in elective outpatient orthopedic cases. We present a 21-year-old male with a history of asthma undergoing elective left shoulder arthroscopy and labral repair surgery under monitored anesthesia care (MAC) after a single-shot peripheral nerve block. In this case, ketofol was used for maintenance anesthesia. This report highlights the potential benefits of ketofol over propofol alone during both intra- and postoperative periods.

Case report

A 21-year-old male with a history of asthma and reactive airway disease since childhood, without recent hospitalizations and no prior ICU stays or intubations, was scheduled to undergo left shoulder arthroscopy and labral repair surgery at our institution. He had no known allergies. On physical examination, he was 188 cm and 100 kg (body mass index: 28.3) with a Mallampati score of 2, his lungs were clear to auscultation bilaterally without wheezes, and he had a regular rate and rhythm on a benign cardiac examination. The patient expressed his desire to be "asleep" throughout the duration of the surgery.

Intravenous (IV) access was obtained and 2 mg of midazolam with 50 mcg of fentanyl was administered. We performed a left interscalene and T2 nerve block and maintained anesthesia with a ketamine–propofol infusion. A total of 25 mL of 0.5% ropivacaine and 15 mL of 1.5% mepivacaine were injected around the trunks of the brachial plexus. An additional 7 mL of 1.5% mepivacaine was used for the T2 nerve block.

The patient was then brought into the operative suite, where standard American Society of Anesthesiologists (ASA) monitors and a nasal cannula were attached. Then, 3 mg of midazolam was administered for anxiolysis, anterograde amnesia, and prophylaxis against potential emergence delirium. The patient was positioned in the beach chair position (BCP), and a propofol infusion at 70 mcg/kg per minute was started with a low background dose of ketamine at 0.2 mg/kg per hour. During the case, the patient was administered an additional 30 mg of IV ketamine in 10 mg aliquots and an initial 30 mg dose of ketorolac toward the end of the procedure for multimodal pain control. At the end of the surgery, 4 mg of IV ondansetron was given; then, the patient woke up calm with no signs of emergence delirium, with adequate analgesia, and with no nausea. Postoperatively, the patient was transferred to the post-anesthesia care unit (PACU), where he was discharged home an hour and a half later after achieving PACU discharge criteria. Columbia University Privacy Office Guidelines do not require Institutional Review Board approval for single case reports as they do not constitute the federal definition of research. Columbia University Medical Center waived the requirements for obtaining written informed consent for single patient case reports. Verbal consent was obtained from the patient for use of this case report.

Discussion

Although shoulder surgery may be conducted in the lateral decubitus position, the majority of surgeons favor the BCP.[10] The BCP offers several advantages to the orthopedic surgeon, but limits the anesthesia provider's access to the patient's airway and may be an indication for endotracheal intubation. Because our patient expressed his desire to be asleep during the procedure, MAC was performed. Our patient was not intubated, and a ketofol admixture was chosen as the primary sedating agent to protect against any untoward anesthetic events. The adjunctive use of ketamine was believed to reduce the risk of airway complication because of ketamine's ability to maintain spontaneous ventilation with bronchodilation[11] and provide a propofol-sparing effect. The addition of ketamine likely introduced an aspiration risk through increased oral and tracheobronchial secretions; however, we believe that the aforementioned benefits in our asthmatic patient outweighed this risk. Increased secretions are a well-known sequelae of ketofol, and studies are being conducted to address this issue.[12]

Another anesthetic consideration for patients positioned in BCP is the subsequent drop in cerebral perfusion pressure following rapid hemodynamic fluctuations.[10] Hypotension in BCP is believed to reduce cerebral perfusion pressure, leading to potential central nervous system ischemia and injury. Compared to general anesthesia, sedation maintains cerebral perfusion and reduces the incidence of catastrophic injury. However, there are currently no studies evaluating the subtle neurocognitive changes as a consequence of less drastic and prolonged hemodynamic fluctuations that are still possible under sedation. The threshold for cerebral hypotension has not been well established, and anesthesiologists should recognize that blood pressure measured at the level of the arm in BCP overestimates cerebral perfusion pressure. The MAP should therefore be maintained as close to baseline as possible. In our case, propofol depressed the MAP, but adjunctive ketamine was believed to have maintained systemic and cerebral perfusion and eliminate the need for phenylephrine.

Several trials[13,14] concerning the use of ketofol versus propofol alone have shown that ketofol consistently preserved MAP without increasing recovery times or adverse event rates. Although larger doses of ketamine in ketofol admixtures may increase PONV and emergence reactions and extend time to discharge,[15,16] adjunctive use of smaller ketamine dosages has been shown to minimize the time discharge.[17] Ketofol also decreased the need for repeat ketamine boluses to fix respiratory desaturations[18] and resulted in faster onset of sedation compared to propofol alone.[19] Our anesthetic approach sought to validate these intraoperative benefits as well as demonstrate an additional analgesic benefit in the immediate postoperative period. Because of the multimodal analgesia provided by ketamine, we were able to reduce our dosing of postoperative opioids for pain relief. No significant side effects were reported for this patient after the procedure. In orthopedic patients, earlier mobilization and adequate pain relief techniques are associated with faster functional recovery[20,21] especially in fast-track surgery programs. In this case, the patient was discharged the same day without complication and began rehabilitation soon after.

Our case report highlights the benefits of ketofol in individuals undergoing outpatient orthopedic procedures. The optimal dosing ratio of ketofol needs further investigation, as there is a lack of standardization in single-syringe ketofol admixtures. The emergency medicine literature favors a 1:1 (ketamine:propofol) ratio, while other reports have experimented with ratios ranging from 1:1 to 1:10. Given the lack of evidence in longer ambulatory procedures, we chose an approximate 1:20 ratio with the intention that the propofol-sparing effect coupled with the direct cardiorespiratory effects of ketamine would offer our patient a balanced and safer anesthetic technique than propofol alone. Although more research is required to optimize ketofol dosing and establish the ideal regimen, we suggest that ketofol's use in MAC can assist with analgesia and achieve quicker PACU recovery than propofol alone.

Disclosure

The authors report no conflicts of interest in this work.

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