Scholars Journal of Medical Case Reports
Abbreviated Key Title: Sch J Med Case Rep
ISSN 2347-9507 (Print) | ISSN 2347-6559 (Online)
Journal homepage: https://saspublishers.com

OPEN ACCESS

Anesthesiology

Successful Remimazolam Re-Induction 120 Minutes After Flumazenil Reversal in A Patient with Septic Shock: A Case Report

Gwanbeom Kim, MD[1], Ji-youn Oh, MD[1], Seokyeon Won, MD[1], Dahye Moon, MD[1], Sein Kwak, MD[1], Hyun Joo Heo, MD[1*]

[1]Department of Anesthesiology and Pain Medicine, Presbyterian Medical Center, Jeonju-city, Jeollabuk-Do, Korea

DOI: https://doi.org/10.36347/sjmcr.2026.v14i05.006 | **Received:** 24.03.2026 | **Accepted:** 30.04.2026 | **Published:** 02.05.2026

***Corresponding author:** Hyun Joo Heo, M.D.
Department of Anesthesiology and Pain Medicine, Presbyterian Medical Center, Jeonju-city, Korea 365 Seowon-ro, Wansan-gu, Jeonju-city, 54987, Korea

Abstract **Case Report**

Remimazolam is a benzodiazepine sedative favored for its hemodynamic stability, yet clinical data regarding its re-induction shortly after pharmacological reversal with flumazenil remains limited. We present a case of a 60-year-old male (50 kg) who developed septic shock due to an anastomosis rupture following a hemicolectomy. Approximately 120 min after receiving a total of 0.45 mg of flumazenil for anesthesia reversal, the patient required emergency re-operation with hemodynamic instability and a drowsy mental status. Despite the recent flumazenil administration, anesthesia was successfully re-induced with a remimazolam infusion at 6 mg/kg/h. Loss of consciousness was achieved without exacerbating hemodynamic instability. The patient was maintained on remimazolam and continuous vasopressor support, recovered well and was transferred to a general ward on postoperative day 8. This case demonstrates that remimazolam re-induction after flumazenil reversal is a viable and safe strategy, even in hemodynamically compromised patients with septic shock. These findings suggest that remimazolam offers a stable anesthetic alternative for emergency re-operations requiring repeat induction shortly after reversal.
Keywords: Remimazolam re-induction, Flumazenil, Remimazolam after flumazenil, Remimazolam in septic shock, Remimazolam in sepsis.

Copyright © 2026 The Author(s): This is an open-access article distributed under the terms of the Creative Commons Attribution **4.0 International License (CC BY-NC 4.0)** which permits unrestricted use, distribution, and reproduction in any medium for non-commercial use provided the original author and source are credited.

INTRODUCTION

Remimazolam is a novel ultra-short-acting benzodiazepine intravenous anesthetic. It provides stable hemodynamics and has a specific reversal agent, flumazenil [1]. Due to these benefits, it is not only safe for high-risk patients [2] but also widely used in situations where rapid recovery is essential, such as awake craniotomy [3] and ambulatory procedural sedation [4].

Flumazenil is a competitive antagonist of benzodiazepines that binds to benzodiazepine receptors for a specific duration to block their effects [5, 6]. Although sugammadex another commonly used reversal agent in anesthesia works through a different mechanism, research on the timing and recommended dosage for rocuronium re-administration after reversal is already well-established [7, 8]. In contrast, there is still a lack of data on the pharmacokinetic changes and clinical effects of remimazolam when it is re-administered within a short interval after competitive antagonism with flumazenil.

We report a case of a patient who required an emergency re-operation for septic shock secondary to anastomosis rupture, which occurred shortly after anesthesia reversal with 0.45 mg of flumazenil following a hemicolectomy. Although remimazolam was re-administered just 120 minutes after the flumazenil injection, re-induction and maintenance of anesthesia were successfully performed without significant hemodynamic instability.

CASE REPORT

The Institutional Review Board of Presbyterian Medical Center approved the study and determined that informed consent was not required, under which the patient's medical records were reviewed. (IRB no. PMC 2026-02-007).

A 60-year-old male patient (height: 178 cm, weight: 50 kg, Body mass index 15.8 kg/m^2) was

admitted for ileus secondary to ascending colon cancer. Although he had no underlying medical conditions, he had recently experienced decreased oral intake and weight loss. Despite four days of conservative management, there was no clinical improvement, and a hemicolectomy was scheduled.

Upon arrival at the operating room for the first surgery, the patient was alert with stable vital signs. Anesthesia induction was initiated with a continuous infusion of remimazolam (6 mg/kg/h). After confirming loss of consciousness and optimal muscle relaxation following the administration of rocuronium (60 mg), endotracheal intubation was performed. Anesthesia maintenance was achieved using a continuous infusion of remimazolam (1 mg/kg/h) and remifentanil. To maintain a stable anesthetic depth and achieve balanced anesthesia, low dose sevoflurane (0.2–0.3 MAC) was co-administered throughout the procedure.

Preoperative X-ray and CT scans revealed significant fecal loading and intestinal gas (Figure 1). During the procedure, suctioning of the intestinal lumen was attempted through the resection site to remove the fecal matter and gas; however, the amount aspirated was less than expected, and the surgery concluded with the anastomosis. Mild hypotension occurred intraoperatively, which was managed with norepinephrine at a dose below 0.1 μg/kg/min; this was discontinued at the end of the surgery. A total of 150 mg of remimazolam was administered over an anesthesia duration of 160 minutes.

Immediately after the surgery, flumazenil (0.3 mg) and sugammadex (150 mg) were administered intravenously for reversal. Although spontaneous breathing was restored, the patient remained sedated 10 minutes after the first flumazenil dose. Following an additional dose of flumazenil (0.15 mg), the patient became fully alert within approximately 2 minutes and was successfully transferred from the operating room.

Figure 1: Preoperative abdomen X-ray and CT Significant amounts of intestinal gas and feces were observed

Approximately 90 minutes after the first surgery, fecal discharge was observed in the surgical drain, accompanied by hypotension. Norepinephrine was initiated at 0.1 μg/kg/min. Suspecting an anastomotic rupture, an emergency re-operation was decided, and the patient was immediately transferred back to the operating room. Prior to the transfer, the patient was alert and hemodynamically stable under norepinephrine support. However, his condition deteriorated acutely immediately upon arrival at the operating room; he became drowsy, and his blood pressure and heart rate dropped to 50/30 mmHg and 90 beats/min, respectively.

Despite increasing the norepinephrine dose to 0.3 μg/kg/min and administering rapid crystalloid infusion, the patient's hemodynamics did not improve. Consequently, epinephrine was added at 0.3 μg/kg/min. We determined that immediate surgical resolution of the anastomosis rupture was more critical than delaying surgery for hemodynamic stabilization. Due to concerns regarding further blood pressure drops from anesthetic agents, remimazolam was cautiously initiated at 6 mg/kg/h. Although etomidate was prepared in case of induction failure, the patient became unresponsive to stimuli after several minutes, indicating successful induction. Considering that only 120 minutes had passed since the prior sugammadex administration, a high dose of rocuronium (80 mg) was administered. After securing an arterial line for invasive BP monitoring and confirming adequate neuromuscular blockade,

endotracheal intubation was performed. Anesthesia was maintained with remimazolam at approximately 1 mg/kg/h, while epinephrine was titrated between 0.2 and 0.5 μg/kg/min. Intraoperatively, the mean arterial pressure (MAP) was maintained between 50–70 mmHg with a heart rate of 110–130 beats/min. A massive amount of fecal matter was found within the peritoneal cavity, which was identified as the cause of the septic shock and severe hemodynamic instability. Following extensive debris removal and massive irrigation, a Hartmann's procedure was performed. The patient was transferred to the ICU postoperatively while remaining intubated, and flumazenil was not used this time. Epinephrine was gradually tapered and discontinued by postoperative day (POD) 4, at which point the patient was successfully extubated. Although the patient experienced postoperative delirium, his mental status stabilized by POD 5, and he was transferred to the general ward on POD 8.

DISCUSSION

The re-induction of anesthesia shortly after the pharmacological reversal of previously administered agents is an infrequent but significant clinical challenge for anesthesiologists. This pharmacological challenge is well-established for neuromuscular blocking agents like rocuronium, where specific dosing protocols following sugammadex reversal have been suggested, such as 1.2 mg/kg after 5 min or 0.6 mg/kg after 4 hours [7, 8]. However, for remimazolam, evidence regarding the optimal timing and dosage for re-administration following competitive antagonism by flumazenil remains scarce.

This case focuses on whether remimazolam effectively functions as a re-induction agent in a septic shock scenario occurring 120 min after reversal with 0.45 mg of flumazenil. The patient had received a total of 0.45 mg of flumazenil at the conclusion of the first surgery, and remimazolam was re-administered 120 min later. Flumazenil is a competitive antagonist at gamma-aminobutyric acid-A receptors with an elimination half-life of approximately 40–80 min [6]. Although the 120-min interval (representing approximately 1.5–2 half-lives) posed a potential for residual flumazenil to interfere with remimazolam binding, loss of consciousness was observed with the remimazolam infusion at 6 mg/kg/h. Remimazolam alone provided sufficient anesthetic depth, and etomidate, though prepared, was not required.

Previous instances of remimazolam re-induction following flumazenil administration have been reported, primarily in the context of awake craniotomy. Yoshida et al. documented a successful re-induction 157 min after the administration of 0.3 mg of flumazenil [9]. In another study, Murata et al. utilized a reduced dose of 0.05 mg of flumazenil to minimize the risk of re-induction failure [5]. Sato et al. reported successful re-induction in eight cases following the administration of 0.2 mg of flumazenil, although the specific time intervals were not provided [3]. In the current case, re-induction was achieved despite a higher flumazenil dose and a shorter time interval compared to these previous reports.

Several factors may have contributed to this successful re-induction. First, the 120-min interval resulted in a decrease in flumazenil plasma concentration to a level insufficient for maintaining potent receptor antagonism. Second, given the patient's drowsy mental status due to septic shock, the hypnotic effect of remimazolam was likely sufficient to offset the residual effects of flumazenil.

Remimazolam is recognized for its advantages in hemodynamic stability compared with other induction agents [1], and its safety and efficacy in patients with septic shock have been documented [10]. Therefore, in scenarios involving hemodynamic instability and septic shock, such as the present case, remimazolam appears to be a favorable option due to its relatively minimal cardiovascular depressant effects. Although continuous vasopressor support with epinephrine and norepinephrine was required intraoperatively, no significant additional decrease in blood pressure was observed immediately following induction. This suggests that the hemodynamic instability was primarily attributable to the underlying sepsis from the anastomosis rupture rather than the direct pharmacological effect of the anesthetic agent.

There are two primary limitations to the present report. First, as the patient's mental status was already depressed prior to induction, it is possible that an adequate depth of anesthesia was observed even if the pharmacological effect of remimazolam was insufficient. Had the patient's mental status been normal, a sufficient depth of anesthesia might not have been achieved. Second, due to the emergency nature of the situation where the patient's blood pressure and mental status deteriorated rapidly, the precise timing and dosage of remimazolam administration, as well as the corresponding changes in the patient's level of consciousness, were not recorded with precision.

CONCLUSION

Remimazolam re-induction appears to be a viable and safe strategy after flumazenil reversal, even in patients with septic shock. This case highlights the clinical utility of remimazolam in hemodynamically compromised patients requiring repeat anesthesia shortly after reversal.

Submission Declaration:

We confirm that this manuscript is original and not plagiarized, has not been submitted elsewhere, and will not be submitted to another journal during the

review process. All authors agree to abide by the publication requirements and policies of SAS Publishers.

REFERENCES

1. Kim SH, Fechner J.: Remimazolam – current knowledge on a new intravenous benzodiazepine anesthetic agent. Korean J Anesthesiol 2022; 75:307–15.
2. Doi M, Hirata N, Suzuki T, *et al.,* Safety and efficacy of remimazolam in induction and maintenance of general anesthesia in high-risk surgical patients (ASA Class III): results of a multicenter, randomized, double-blind, parallel-group comparative trial. J Anesth 2020;34(4):491-501.
3. Sato T, Nishiwaki K.: Comparison of remimazolam and propofol in anesthetic management for awake craniotomy: a retrospective study. J Anesth 2022; 36 :152–155.
4. Rex DK, Bhandari R, Desta T, *et al.,* A phase III study evaluating the efficacy and safety of remimazolam (CNS 7056) compared with placebo and midazolam in patients undergoing colonoscopy. Gastrointest Endosc 2018;88(3):427-437.
5. Murata H, Yokoyama A, Hara T.: Remimazolam and low-dose flumazenil for awake craniotomy. J Anesth 2022; 36:789–90.
6. Sivilotti ML.: Flumazenil, naloxone and the 'coma cocktail'. Br J Clin Pharmacol 2016; 81:428–36.
7. Schaller SJ, Fink H.: Sugammadex as a reversal agent for neuromuscular block: an evidence-based review. Core Evid 2013; 8:57–67.
8. Cammu G, de Kam PJ, De Graeve K, *et al.,* Repeat dosing of rocuronium 1.2 mg kg−1 after reversal of neuromuscular block by sugammadex 4.0 mg kg−1 in anaesthetized healthy volunteers: a modelling-based pilot study. Br J Anaesth 2010; 105:487–92.
9. Yoshida A, Kurata S, Kida K, *et al.,* Anesthetic management for the sleep-awake-sleep technique of awake craniotomy using a novel benzodiazepine remimazolam and its antagonist flumazenil. JA Clin Rep 2021;7(1):14.
10. Dai QC, Zhao JL, Miao XY, *et al.,* Effects of different doses of remimazolam on hemodynamics during general anesthesia in patients with septic shock. Eur Rev Med Pharmacol Sci 2024;28(6):2483-2492.