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Hip fractures occur commonly in elderly patients. Many of these patients have multiple comorbidities requiring the use of anticoagulants. Some of the newer anticoagulants have no reliable method for reversal. This case report discusses the advantages and pitfalls of the selection of local anesthetic and monitored anesthesia care using a propofol-ketamine-lidocaine admixture for an elderly patient with a femoral neck fracture who was receiving dabigatran etexilate (Pradaxa). This case illustrates the potential for sedation during monitored anesthesia care to progress to general anesthesia and its associated risks as well as special considerations for anesthesia in geriatric patients.

Keywords: Dabigatran, elderly, hip fracture, “ketofol,” propofol-ketamine-lidocaine.

As the population ages, providing safe and effective anesthesia for our elderly patients is a growing concern for anesthesia providers. Hip fractures are common in the geriatric population, with an incidence of approximately 950 hip fractures occurring for every 100,000 elderly patients in the United States.1 Twice as many hip fractures are seen in women compared with men.1 While hip fracture rates and mortality are actually decreasing in the elderly population, comorbidities for these patients are increasing, with the most common being congestive heart failure, chronic pulmonary disease, and diabetes.1

Despite the declining rates of hip fractures and mortality in the elderly since 1995, mortality is still 30% within 1 year of injury, and there is substantial loss of function in those who survive.1 Although surgical intervention for hip fractures is typically not considered an emergency, delaying surgery is associated with an overall deterioration of the patient’s condition and subsequent increases in morbidity and mortality in these patients because of the sequelae of immobility and pain.2,3

Dabigatran etexilate (Pradaxa, Boehringer Ingelheim Pharmaceuticals Inc) is a direct inhibitor of thrombin, which is prescribed for patients who have nonvalvular atrial fibrillation for the prevention of stroke and embolism.1 There is no reversal agent for dabigatran, and therefore the manufacturer recommends that its use be discontinued for 1 to 5 days before any surgical procedure, or even longer for patients undergoing major surgery or before placing neuraxial anesthesia.4

Spinal anesthesia is a popular anesthetic choice in hip fracture repair in elderly patients to avoid the risks associated with general anesthesia in this population, but it was contraindicated in the case presented here because of the patient’s dabigatran use. Although current studies do not illustrate long-term differences in recovery after surgical intervention for hip fractures between regional anesthesia (RA) and general anesthesia in the elderly, avoiding general anesthesia in this patient is desired because of the patient’s history of asthma as well as chronic atrial fibrillation, hypertension, and hyperlipidemia.5 Therefore, local anesthetic and monitored anesthesia care (MAC) using a propofol-ketamine-lidocaine admixture was selected as the anesthetic technique in this case. Regardless of the intention for the case to remain within the criteria for that of a MAC case, portions of the case illustrated the possible progression of the patient from deep sedation and analgesia to general anesthesia, with all its associated risks.

Case Summary
An 86-year-old female patient, who appeared much younger than her stated age, was scheduled for in situ pinning of an impacted right femoral neck fracture 28 hours after injury. The fracture occurred after a fall while the patient was gardening and pulling weeds in a ditch. The patient’s past medical history included chronic atrial fibrillation, hypertension, hyperlipidemia, hypothyroidism, and asthma. Current medications were dabigatran, 150 mg twice daily, as well as alendronate sodium, diltiazem, and levothyroxine sodium. The last dose of dabigatran was taken in the morning on the day of injury and subsequent hospital admission. The patient reported allergies to penicillin, ciprofloxacin, sulfa, sulfamethoxazole-trimethoprim (Bactrim), and tetanus toxoid. She also reported a surgical history of cholecystectomy, tonsillectomy, right total knee re-
The patient was 170.2 cm (5 ft 7 in) tall and weighed 64 kg, with a body mass index of 21.9 kg/m². The patient’s exercise tolerance was good, with no chest pain or shortness of breath with stair climbing. A cardiac consultation was not obtained because of the stability of the patient’s hypertension and lack of acute cardiac symptoms. The patient had nothing to eat or drink by mouth (NPO) for more than 12 hours before surgery and received maintenance intravenous (IV) fluids during the preoperative period. Intravenous fluids were adequate to maintain appropriate diuresis during the period that the patient remained NPO.

Preoperative vital signs were blood pressure (BP) of 130/76 mm Hg, heart rate (HR) of 60/min, respiratory rate of 20/min, temperature of 36.6°C (97.9°F), and the oxygen saturation (SpO₂) measured via pulse oximetry was 98% on room air. On physical examination, the patient was oriented, with an appreciable irregular heart rate. Substantial bruising was seen only at the injury site, with no other signs or symptoms of occult bleeding. Lungs were clear to auscultation. Findings of the airway examination revealed a Mallampati score of 2 with full range of motion of the neck, a thyromental distance of greater than 3 cm, and intact teeth. A 12-lead electrocardiogram (ECG) obtained the day of surgery showed atrial fibrillation with S-T abnormality and possible inferior ischemia or left ventricular strain. Relevant laboratory results included hemoglobin of 13.9 g/dL, hematocrit of 41.6%, platelets of 256 × 10³/µL prothrombin time (PT) of 16.5 seconds, international normalized ratio (INR) of 1.35, and partial thromboplastin time of 47.5 seconds. A review of laboratory values relevant to renal and liver function shared no evidence of dysfunction in either system.

Before leaving the preoperative area, the patient was given 2 mg of midazolam and 50 µg of fentanyl IV. After arriving in the operating room (OR), the patient received 10 L/min of supplemental oxygen (O₂) by simple mask, and standard noninvasive monitors of noninvasive BP cuff, pulse oximeter, skin temperature monitor, and 3-lead ECG were applied. The patient was only lightly sedated on arrival in the OR, with normal responses to verbal commands and SpO₂ of 98%. While still in the hospital bed, the patient was medicated with additional doses of midazolam (2 mg) and fentanyl (50 µg) as well as ketamine (25 mg) IV at which point the patient was verbally responsive to mild, repeated prodding. The patient was then moved from the hospital bed onto the fracture table and positioned for surgery. Additional boluses of fentanyl, 50 µg, and midazolam, 1 mg, IV were given during positioning in response to the patient’s verbal expression of discomfort.

Anesthesia during the procedure was maintained using a propofol-ketamine-lidocaine admixture containing propofol, 145 mg (10 mg/mL); ketamine, 25 mg (50 mg/mL); and lidocaine, 50 mg (10 mg/mL), placed in a 20-mL syringe using sterile technique. The propofol-ketamine-lidocaine admixture therefore contained the following concentrations: propofol, 7.25 mg/mL; ketamine, 1.25 mg/mL; and lidocaine, 2.5 mg/mL.

End-tidal carbon dioxide monitoring was initiated, and an initial bolus dose of propofol-ketamine-lidocaine (2 mL) was given. A 9-mm oropharyngeal airway was placed to maintain airway patency after the patient was unresponsive to verbal prodding and demonstrated substantial snoring. While the patient maintained spontaneous breathing, respirations were assisted by mask for less than 5 minutes following the initial propofol-ketamine-lidocaine bolus to preserve adequate oxygenation, during which time the patient remained hemodynamically stable. The patient was then prepared and draped for surgery.

Subsequently, the surgeon instilled the operative site with 40 mL of 1% lidocaine with epinephrine. During the instillation of local anesthetic and throughout the remainder of the operative procedure, the propofol-ketamine-lidocaine infusion was manually titrated into the maintenance IV fluid line to maintain a deep level of sedation and analgesia while keeping vital signs within 20% of baseline and the SpO₂ greater than 98%. No further ventilatory assistance was needed during the procedure. No attempt to verbally engage the patient during the course of the procedure was made, as the patient appeared to be free of pain and was stable from a respiratory and hemodynamic prospective.

The surgeon completed the in situ femoral neck fracture pinning by placing 3 guidewires, followed by 3 screws over the guidewires, using multiplanar fluoroscopy. The wound was then irrigated and closed, and a sterile dressing was placed. Estimated blood loss for the surgical procedure was 250 mL; the patient received 700 mL of isotonic crystalloid intraoperatively, and urine output measured by Foley catheter during the procedure was 200 mL. The length of the operating procedure was 50 minutes.

Following successful pinning of the patient’s hip fracture and closure of the operative site, the patient was transferred back onto the hospital bed, at which time propofol-ketamine-lidocaine administration was discontinued. Oxygen saturation at the conclusion of the procedure was 99%, with continued administration of 10 L/min of O₂ by simple mask and unassisted ventilation. During the 50-minute procedure, 10 mL of the propofol-ketamine-lidocaine infusion had been administered, which included the initial 2-mL bolus of propofol-ketamine-lidocaine, for an average infusion rate of 0.2 mL/min with total doses of 72.5 mg of propofol, 25 mg of lidocaine, and 12.5 mg of ketamine.
The patient was administered 10 L/min of supplemental \( \text{O}_2 \) during transfer to the postanesthesia care unit (PACU). Vital signs on admission to the PACU were BP of 119/58 mm Hg, HR of 70/min, respiratory rate of 12/min, and temperature of 37.0°C (98.6°F). The patient was asleep with the oropharyngeal airway in place and showed no signs of distress. Thirty minutes after arriving in the PACU, the patient complained of pain rated as 1 of 10 on the comparative pain score, and 2 mg of IV morphine was given. No additional medications for analgesia were required in the PACU, and the patient was transferred back to the ward fully awake, in stable condition, and pain free after a 55-minute PACU stay.

Postoperative pain on the ward was controlled first using a patient-controlled analgesia pump with morphine, then with boluses of IV morphine, and finally with oral analgesics. The patient had an unremarkable postoperative course and was subsequently transferred to a short-term nursing facility for rehabilitation on postoperative day 3.

Discussion

Several challenges face anesthesia practitioners when providing care to elderly trauma patients experiencing hip fractures. Substantial comorbidities and anesthetic implications related to current drug regimens and physiologic changes occur in patients as a result of aging, and the need exists for timely intervention to decrease mortality and improve functional outcomes.

Several physiologic changes occur in the geriatric population that are relevant to administration of anesthesia. Changes are seen in both the overall anatomy and physiology of the patient as well as all body systems, including the cardiovascular, respiratory, renal, biliary, endocrine, and central nervous systems. Pharmacokinetics and pharmacodynamics in the elderly patient are also significantly altered. However, many pharmacokinetic and pharmacodynamic changes in the elderly are very patient-specific and depend on the individual patient's body habitus and hepatic and renal function.

In general, advanced age affects the metabolic rate of patients and the pharmacodynamics of anesthetic medications. Most relevant for anesthetic management in this population is the need to decrease doses of many anesthetic agents, including minimum alveolar concentrations of volatile anesthetics, hypnotics, local anesthetics, opioids, barbiturates, and benzodiazepines. Care should be taken with dosing of all anesthetic agents. Minimum alveolar concentrations for volatile anesthetics should be reduced by 4% per decade after age 40 years, and doses of all other drugs that affect the central nervous system should be decreased by as much as 40%.

The decreased metabolic rate seen in the aging patient affects the pharmacokinetics of drugs given in the course of anesthesia. A smaller volume of intravascular blood will cause a higher plasma concentration of drug when first administered. When this is combined with the decreased protein binding of drug found in this population, leading to an increased level of free drug, the result is that an elderly patient needs decreased doses of many drugs. Because geriatric patients have a higher lipid compartment, more lipid-soluble drugs can have a longer half-life than in the younger patient.

Regarding the presented case, most concerning was the patient's history of hypertension, hyperlipidemia, and chronic atrial fibrillation. Normal aging prevents elderly patients from effectively compensating for increased \( \text{O}_2 \) demand, hypovolemia, or fluid overload, and patients with preexisting cardiac conditions have even more difficulty when presented with these changes. The patient's history of atrial fibrillation and the need to temporarily halt anticoagulation therapy was especially concerning, increasing the risk of a thromboembolic event postoperatively. This patient was also vulnerable to experiencing hypotension intraoperatively, given a history of hypertension.

The literature is inconclusive regarding the best anesthetic technique for elderly patients requiring hip fracture repair. Several studies have reported no differences in overall mortality between elderly patients receiving RA as opposed to general anesthesia, while others have found significant decreases in morbidity and mortality with the use of RA. The latest comparison of anesthetic techniques for this patient population was a large-scale study with more than 18,000 patients, which found that RA was associated with a 25% to 29% decrease in both major pulmonary complications and mortality. A Cochrane review of the existing literature on the subject appropriately points out that the choice of regional vs general anesthesia in geriatric patients requiring surgery for hip fracture should be individualized based on the patient's preference and coexisting diseases. No studies were found examining outcomes in these patients when sedation with MAC was employed.

With sedation under MAC, the anesthetist must carefully titrate anesthetics and analgesics to achieve the desired level of sedation. The benefits of a MAC anesthetic technique with deep sedation, as opposed to either regional or general anesthesia, include fewer complications during anesthesia and recovery, fewer medication side effects, and increased patient satisfaction. The 1999 American Society of Anesthesiologists (ASA) publication *Continuum of Depth of Sedation: Definition of General Anesthesia and Levels of Sedation/Analgesia*, amended in 2009, set forth the definitions for various levels of sedation used in the course of anesthesia. The 4 different distinct levels of sedation and analgesia that the ASA recognizes are minimal sedation (anxiolysis), moderate sedation/analgesia (conscious sedation), deep sedation/analgesia, and general anesthesia. A patient is classified as falling into one of these levels based on evaluation of 4...
factors: responsiveness, airway, spontaneous ventilation, and cardiovascular function.12

With minimal sedation the patient has a normal response to verbal stimulation, and the airway, spontaneous ventilation, and cardiovascular function are unaffected.12 In moderate sedation/analgesia, also referred to as conscious sedation, the patient remains purposeful to verbal or tactile stimulation, may require intervention to maintain a patent airway, may or may not have adequate ventilatory status, and usually maintains baseline cardiovascular function.12 With deep sedation/analgesia the patient is responsive only to repeated or painful stimulus, may require intervention to maintain a patent airway, may or not have adequate ventilatory status, and usually maintains baseline cardiovascular function.12

Finally, general anesthesia occurs when the patient no longer responds to a painful stimulus, often requires intervention to maintain a patent airway, frequently has inadequate spontaneous ventilations, and may have impaired cardiovascular function.12 Within the umbrella of MAC, all levels of sedation short of general anesthesia are included.12

The choice of anesthetic technique used during repair of hip fractures in the elderly also largely depends on the type of fracture, because some fractures can be repaired with less invasive surgical procedures, lending more flexibility to selection of anesthesia technique. This patient had a diagnosis of a valgus impacted right femoral neck fracture, which can be repaired surgically by minimally invasive percutaneous pinning using local anesthesia, as well as by more invasive methods such as intramedullary nailing, hemiarthroplasty, or total hip replacement.13

The primary limiting factor in the choice of anesthetic methods for this case was the patient’s use of dabigatran as an anticoagulant for the treatment of chronic atrial fibrillation. Dabigatran is a direct reversible inhibitor of thrombin when the active ingredient, the prodrug dabigatran etexilate, is converted to dabigatran.14 When thrombin is inhibited, it cannot convert fibrinogen to fibrin, and therefore thrombin-induced platelet aggregation is hindered, preventing blood clots from forming.14 Dabigatran has a half-life of 14 to 17 hours and is primarily metabolized renally.14

The advantages of dabigatran over warfarin in the prevention of formation of blood clots in patients with chronic atrial fibrillation include a fixed dosing regimen and the avoidance of frequent blood tests to monitor anticoagulation status.14 The disadvantages of dabigatran are that it cannot be reliably antagonized by any method, and coagulation studies(561,121),(923,138)(521,114),(778,129) do not accurately reflect the extent of anticoagulation present in patients receiving this medication.14-16

Results of standard coagulation studies such as PT and INR, while they may be elevated in a patient receiving dabigatran, do not correlate with the patient’s current anticoagulation status.15,16 Although thrombin clotting time and ecarin clotting time have been put forth as possible measures that can be evaluated to determine anticoagulation status in patients receiving dabigatran, many healthcare facilities, including the one where this case was performed, do not have the means to perform these tests on-site, as they require specialized laboratory equipment.15,16 Activated clotting time obtained by thromboelastography has been shown to be consistently elevated in trauma patients receiving therapeutic doses of dabigatran, but activated clotting time lacks the sensitivity to make it a reliable method for determining dabigatran levels.16

Some of the normal antidotes to anticoagulants such as vitamin K and coagulation factors that depend on vitamin K have failed to reliably reverse dabigatran.14-16 Although recombinant factor VII, prothrombin complex concentrate, fresh frozen plasma, and dialysis have all been suggested for use in emergency situations, none of these has been proved to effectively reverse coagulation abnormalities in patients receiving dabigatran.14,15

The lack of effective reversal for this medication has been associated with life-threatening and even fatal hemorrhage.15 Factors that have been linked with such bleeding events and dabigatran use include other bleeding diathesis, concurrent use of antiplatelet agents, renal dysfunction, falls, and geriatric status.15

Because dabigatran is primarily excreted renally, a correlation between creatinine clearance (CrCl) and therapeutic effect of dabigatran has been established in the presence of normal CrCl, as evidenced by a CrCl of greater than 80 mL/min/1.73 m², and with adequate fluid volume.16 Because of the relationship between CrCl and the half-life of dabigatran, it has been postulated that therapeutic levels of dabigatran will be eliminated by approximately 50% between 12 and 14 hours after the patient’s last dose, with minimal anticoagulation remaining by 24 hours after the last dose, given that the patient has received adequate fluid administration and diuresis.16 These times will be extended in patients with decreased CrCl.16 An interval of 48 to 72 hours after the patient’s last dose has been suggested as the appropriate time to consider surgical intervention in patients receiving dabigatran.16

In the present case, the surgical and anesthesia teams discussed the half-life of the drug, and the patient’s normal renal and coagulation study laboratory values as well as the expected blood loss associated with percutaneous pinning before deciding to proceed with surgical repair of this patient’s hip fracture at 28 hours after the last dose of dabigatran. Because the manufacturer recommends that dabigatran be discontinued for longer than 5 days before placing neuraxial anesthesia, a spinal or epidural anesthetic method for this surgery was immediately rejected.4

The selection of percutaneous pinning as the surgical

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method for repair of the patient’s femoral neck fracture, as well as the surgeon’s support, allowed the anesthesia team to opt for local anesthetic infiltration under MAC as opposed to general anesthesia. Deep sedation and analgesia with MAC was planned in this case to provide the patient with maximal comfort while minimizing anxiety, fear, awareness, and pain during the procedure.17

Some of the medications that can be used with MAC include midazolam, propofol, fentanyl, and ketamine. In this case a combination of these agents was chosen for anesthesia delivery. The selection of propofol-ketamine-lidocaine as the maintenance anesthetic for this surgery was made because of the ability of the mixture of these drugs to negate the disadvantages of using each drug independently. There is a lack of standardization for the composition of admixtures commonly used in the clinical setting for sedation as well as in various clinical trials that have been performed using these drug combinations.18-20

Propofol is the most popular sedative-hypnotic used to supplement RA.11 Its advantages in procedural sedation include rapid induction, anticonvulsant effects, and reduced postoperative sedation, amnesia, and postoperative nausea and vomiting (PONV) with downsides of dose-dependent respiratory depression, hypotension, pain on injection, and lack of analgesic effects.11,18 Lidocaine was added to the mixture simply to diminish the pain of injection associated with propofol. The customary dose of 1 mg/kg was used as a guide in determining the amount of lidocaine for the admixture, with a dose of approximately 0.8 mg/kg placed in the admixture.

Ketamine is a dissociative amnestic that blocks communication between the limbic and thalamic areas of the brain, which then prevents recognition of stimulus that occurs externally.18 Ketamine has several advantages to its use, including amnestic and analgesic properties, preservation of muscle tone and airway reflexes, bronchodilation, and a lack of respiratory and cardiovascular depression, whereas its disadvantages include emergence hallucinations, sympathomimetic effects, and increased incidence of PONV.18,19 Bronchodilation associated with the administration of ketamine was an especially positive attribute for use with this patient, given the patient’s history of asthma.

The propofol-ketamine-lidocaine solution properties make it an ideal anesthetic agent for sedation in patients with cardiovascular disease. Because propofol causes hypotension while ketamine administration increases blood pressure and heart rate, the combination of these 2 drugs theoretically results in hemodynamic stability in this patient population.18,19 In addition, the respiratory depressant properties of propofol should hypothetically be canceled out by ketamine, which is known to help patients better protect their airway and maintain spontaneous respirations.18,19 The propensity for ketamine to cause PONV should also be attenuated by the antiemetic properties of propofol.18,19 Finally, because the 2 drugs have synergistic sedative properties, lower doses of each should be effective for maintaining sedation during MAC procedures.18

Current literature regarding the use of the propofol-ketamine anesthetic technique, sometimes referred to clinically as “ketofol,” in the adult population shows that it has varying success in fully negating the adverse effects of each of its composing agents. In multiple studies comparing propofol-ketamine with propofol-fentanyl admixtures during a variety of anesthetic techniques, both increased and decreased respiratory in the propofol-ketamine group has been reported as well as an increased incidence of nausea, vertigo, and visual disturbances, leading to longer discharge times and lower rates of patient satisfaction.18 These studies have also reported lower incidences of hypotension, apnea, and improved hemodynamics with propofol-ketamine admixture.18,19 In case reports examining ketamine-propofol as an adjunct to RA, it was shown to be effective in providing adequate analgesia, maintaining spontaneous respiration and hemodynamic stability, and promoting a rapid recovery time.20

As reported in the literature, the use of the propofol-ketamine-lidocaine admixture in this case resulted in varying degrees of success in attenuating the disadvantages of either propofol or ketamine administered alone. The primary goal in the use of propofol-ketamine-lidocaine for this patient was to maintain hemodynamic stability given the patient’s history of hypertension and chronic atrial fibrillation. Propofol-ketamine-lidocaine met this goal, as evidenced by the maintenance of blood pressure within 20% of baseline without the need for administration of fluid boluses or vasoactive drugs. This patient also failed to experience PONV, and pain control via propofol-ketamine-lidocaine and local anesthetic administration was adequate, requiring only 2 mg of morphine IV for breakthrough pain in the PACU.

The goal of using the propofol-ketamine-lidocaine admixture was to keep the patient strictly within the realm of a MAC anesthetic. However, this did not occur in this case. Because of a minimal response to the initial dosing of sedatives and analgesics in both the preoperative area and during movement and positioning of the patient, the anesthesia practitioner’s initial dose of propofol-ketamine-lidocaine during anesthesia maintenance, in addition to previously administered doses of midazolam, fentanyl, and ketamine, likely moved the patient from the deep sedation/analgesia level of the continuum of anesthesia into the realm of a general anesthetic. This was evidenced by the need for insertion of an oropharyngeal airway and BVM ventilation as well as a lack of purposeful response by the patient, although the practitioner did not attempt to elicit a response from the patient by painful stimulation during the maintenance phase of anesthesia.

By ASA definition, the need for assistance in maintain-
ing a patent airway and independent ventilatory function does not automatically classify the case as a general anesthetic.12 Regardless, loss of control of spontaneous ventilation by the patient was not intended by the practitioner and introduced potential unintended risks to the patient. The risks introduced included the potential for an inability to provide adequate ventilatory support or the loss of the patient’s airway resulting in the need to obtain a definitive airway during the operative procedure under less than optimal conditions. There also was a risk for aspiration and related serious sequelae.

Studies have shown that general anesthesia frequently occurs in the geriatric population when using propofol-based sedation, particularly when sedation is not carefully titrated using an objective measure such as bispectral analysis.21,22 It has also been postulated that the failure of literature to consistently find improved outcomes between RA and general anesthesia for elderly patients undergoing hip fracture repair may be because those undergoing RA with sedation may be experiencing sedation levels comparable to general anesthesia.21 The likely migration of this patient from MAC with deep sedation to general anesthesia during a portion of this procedure may have been avoided by titrating sedation to an objective measure such as bispectral analysis.

Although the patient did not experience any perioperative complications because of the anesthetic administered during this case, serious complications certainly could have occurred. It behooves the anesthesia practitioner to keep in mind the pharmacokinetics and pharmacodynamics unique to the geriatric population and to use judicious administration of sedatives and analgesics in this patient population. In addition, the relatively small dose of ketamine present per milliliter of the propofol-ketamine-lidocaine admixture was likely insufficient to maintain adequate spontaneous ventilations in the patient.

Given the potential for serious airway complications with the selected anesthetic technique, general anesthesia using a total IV anesthetic and securing the airway with a laryngeal mask airway would have been a safer alternative for this patient. The same or similar admixture could have been used to maintain hemodynamic stability in the patient, which was the primary concern with employing general anesthesia in this patient. Alternatively, small amounts of sedatives and analgesics could have been used during the positioning and injection of local anesthetic, coupled with verbal reassurance during the remainder of the procedure in lieu of the propofol-ketamine-lidocaine admixture for anesthetic maintenance. This would have avoided the potential for sedation to progress from a deep level of sedation to a general anesthetic, providing an even safer anesthetic in this patient.

As previously stated, the widespread use of anticoagulants without reliable reversal methods in the geriatric patient population, who are prone to hip fractures, does present a major challenge to anesthesia providers. Selection of percutaneous pinning to repair this patient’s nondisplaced femoral neck fracture allowed for greater flexibility in selecting the anesthetic technique for this patient and the effective early repair of this patient’s hip fracture, even though the patient likely remained partially anticoagulated with dabigatran at the time of the procedure.

Some major factors limit the generalization of the method described in this case report to other similar cases. There is a lack of standardization in the formulation of propofol-ketamine admixtures in the current case literature and in clinical practice, which limits the ability to anticipate the patient response to any given formulation. The manual titration of the propofol-ketamine-lidocaine infusion used in this case hinders other practitioners from replicating or predictably modifying the method used for this patient’s anesthetic to achieve a given level of sedation. Finally, although this geriatric patient was 86 years old and had multiple comorbidities, the patient was in otherwise excellent physical condition. Her condition likely limits the applicability of this case report to other similarly aged geriatric patients with like comorbidities and drug regimens.

REFERENCES


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