

Intentional intra-arterial injection of midazolam in a patient with status epilepticus in the Intensive Care Unit

ABSTRACT

Fundamental medical care includes intravenous (IV) access which provides prompt resuscitation and reliable delivery of analgesics, antibiotics, and vasoactive medication. Difficult access populations, especially in critical area, continue to challenge providers to consider and utilize alternative means to provide IV access. Potential options under such circumstances include intramuscular, intraosseous, and intratracheal drug administration, but in extreme cases where no other options are available, intra-arterial route might be considered. We present a case where midazolam was intentionally injected intra-arterially to abort seizure activity in a patient with status epilepticus in the Intensive Care Unit.

Key words: Difficult access; intra-arterial; midazolam

Introduction

Anesthesiologists routinely deal with difficult intravenous (IV) cannulations, and sometimes, it is accompanied with emergency situation. It has been reported that up to 23% of patients can present with difficult IV cannulation.^[1] Moreover, other parenteral routes of drugs administration are well established in the literature include intramuscular (IM), subcutaneous, inhalational, and intraosseous (IO).^[2] Another way of administering drugs could be intra-arterial (IA), but it is reported to be associated with complications such as severe pain, phlebitis, thrombosis, limb ischemia, and vessel wall injury.^[3] Multiple cases of inadvertent IA injection of anesthetic drugs have been reported and show conflicting results.^[3,4] However, a very limited literature is available on intentional use of IA cannula for injecting drugs.^[5] Here, we present a case where midazolam was intentionally injected intra-arterially to abort seizure activity in a patient with status epilepticus in the Intensive Care Unit (ICU).

Case Report

A 29-year-old, 79.5 kg female patient was known to have migraine and epilepsy for the last 12 years. She was treated for tuberculosis meningitis 12 years back and was on antiepileptic drugs (AED) but stopped AED after consultation with the neurologist for the last 1 year as she was seizures free. She underwent cesarean section under spinal anesthesia due to previous uterine scar and remained stable throughout the procedure. On the 1st postoperative day, the patient had an event of generalized tonic-clonic seizure (GTCS) lasted for 30–60 s. Neurology team was taken on board and the patient was loaded with 1 g IV levetiracetam and 500 mg BID. Magnetic resonance imaging (MRI) brain and electroencephalogram (EEG) advised. MRI was tried but failed due to patient's restlessness. However, EEG showed diffuse theta slowing along with intermittent delta bursts. On the

This is an open access article distributed under the terms of the Creative Commons Attribution-NonCommercial-ShareAlike 3.0 License, which allows others to remix, tweak, and build upon the work non-commercially, as long as the author is credited and the new creations are licensed under the identical terms.

For reprints contact: reprints@medknow.com

How to cite this article: Ali MA, Yahya M. Intentional intra-arterial injection of midazolam in a patient with status epilepticus in the intensive care unit. Saudi J Anaesth 2017;11:476-8.

Access this article online	
Website: www.saudija.org	Quick Response Code 
DOI: 10.4103/sja.SJA_93_17	

MUHAMMAD ASGHAR ALI, MUHAMMAD YAHYA

Department of Anaesthesia, Aga Khan University, Karachi, Pakistan

Address for correspondence: Dr. Muhammad Asghar Ali, Department of Anaesthesia, Aga Khan University, Karachi, Pakistan.
E-mail: asghar.ashraf@aku.edu

3rd postoperative day, the patient had another event of GTCS lasted for about 40 s with a drop in Glasgow Coma Scale (7/15) along with loss of protective airway reflexes. The patient was loaded with valproic acid 1.5 g and 500 mg BID. The patient was intubated for airway protection and shifted to ICU for further management. On arrival in the ICU, the patient had only a right forearm 22-gauge IV cannula. An arterial cannula in the right radial artery was placed just after patient's arrival in ICU by the on-call anesthesia resident for the purpose of blood sampling and monitoring blood pressures. Just after the establishment of arterial cannula, patient had another event of GTCS with severe jerky movements and the only IV cannula got dislodged. Due to difficult IV cannulation and intense generalized jerky movements, the on-call team failed to maintain an IV line despite multiple attempts. It was now 10 min and patient was continuously seizing. Therefore, after analyzing risk versus benefit ratio, it was decided by the on-call ICU team to inject a diluted injection of midazolam through the established arterial cannula. Midazolam 5 mg (1 mg/ml) was diluted in 20 cc syringe (5 ml midazolam + 15 ml normal saline) and was injected slowly 1 mg (4 ml)/20 s. Seizures activity was successfully aborted with 4 mg (16 ml) of IA diluted midazolam. Central venous catheterization was immediately done afterward. She was strictly monitored for adverse reactions especially for signs of ischemia and no immediate or delayed adverse reactions were observed. She was successfully extubated after 3 days, and subjectively, there was no complaint of pain or discomfort at the injection site.

Discussion

Difficult or impossible venous access occasionally occurs especially in patients exposed to repeated surgical procedures or those with underlying comorbid features. Potential options under such circumstances include IM, IO, and intratracheal (IT) administration. However, the onset of action of medications is delayed with IM administration, while IT administration requires the presence of an endotracheal tube.^[6] In the emergency situation, the IO route is recognized as the preferred option, but it can be used in children up to 6 years of age,^[2] while the IA use for drug administration especially in the critical care area when IV access is not available has been questioned. Although it was common practice during the Korean War, it was abandoned by 1965, when it was obvious that the IA route did not have any advantage and had far more complications compared with IV access.^[7] Despite the current perception that IA injection is not usually a viable option for the administration of medications, there are several reports in the literature of both the intentional and inadvertent uses of this route. Depending on the medication injected, there is also a wide

range of outcomes ranging from no sequelae to gangrene, resulting in amputation and even death.^[8]

It is difficult to establish the incidence of complication of IA injections as many cases go unreported. Estimates by certain authors place incidence of this complication between 1:3500 and 1:56,000.^[9] Many commonly used drugs such as phenothiazines, meperidine diazepam, promazine, barbiturates, tubocurarine, amphetamines, and strophanthin have been found injurious when given intra-arterially. Complications of IA injection of nonaqueous agents (phenytoin, propofol) and highly alkaline drugs (thiopentone) are well documented. Although lipid-soluble drugs are known to cause more complications if given intra-arterially, anesthetic drugs such as atropine, fentanyl, and vecuronium have been used without any deleterious effects.^[8] It is known that complications after accidental IA injections are closely related to the drugs injected, highlighting the pH and osmolality as the most important factors determining the sequelae. Hence, according to various investigators, high pH or high osmolality of injected medication can result in more severe complications, occurring also later in the peri- and post-operative period.

Boucek and Abu El Magd^[9] described their unique approach of using a planned combination of IO, IA, and surgically fashioned venous sites, in a 52-year-old woman scheduled for multivisceral transplantation after 20 years of total parenteral nutrition and several complications of a prior surgery including small bowel necrosis, total removal of the jejunum and ileum, and ultimately hepatic failure. Three arterial catheters were percutaneously placed a 20-gauge left radial arterial catheter, an 8.5-Fr left femoral arterial catheter, and a 7-Fr right femoral arterial double-lumen catheter. A continuous infusion for medication administration was begun using one port of the right femoral arterial line, while blood products and fluids were administered through both femoral arterial lines using infusion pumps. The patient received 2 L of colloid and blood intra-arterially before obtaining acceptable venous access through the inferior mesenteric and ovarian veins during laparotomy.

Although guidelines are not available, case reports and review reported that water-soluble drugs and drugs with pH closer to arterial blood pH may be used through IA route. Among the anesthetic drugs that have been injected intra-arterially without adverse effects are fentanyl, midazolam, succinylcholine, pancuronium, and atropine.^[5]

From the limited reports of the intentional IA administration of medications combined with the numerous reports of accidental IA injection, there is anecdotal information in

the literature regarding the administration of medications through the IA route. The majority of these reports contain only a single case, and therefore, it is not possible to make a definitive statement regarding the safety of the IA administration of many of these medications. Other issues which may impact on the safety of the IA route include the site of the arterial catheter. As femoral arterial catheters are generally in an area of higher flow than radial arterial catheters, we would speculate that they provide a higher margin of safety than radial arterial catheters. Regardless of the site, meticulous attention should be directed to avoiding the inadvertent administration of air or particulate matter and the use of an inline filter may further enhance the safety of this technique. If this technique is used, ongoing monitoring of distal perfusion is required. The latter may be facilitated by the placement of a pulse oximeter at the distal site.

In summary, we report the intentional use of the IA route for the administration of midazolam to abort seizures, in whom venous access could not be obtained. In our patient, we noted a rapid onset of action of midazolam to abort seizures without any side effects. Despite of that, we managed our patient successfully, and this technique is not recommended for elective cases; however, in case of emergency, the risks and benefits of the IA route should be weighed against other options when venous access cannot be obtained.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

References

1. Jacobson AF, Winslow EH. Variables influencing intravenous catheter insertion difficulty and failure: An analysis of 339 intravenous catheter insertions. *Heart Lung* 2005;34:345-59.
2. Verma P, Thakur AS, Deshmukh K, Jha AK, Verma S. Routes of drug administration. *Int J Pharm Stud Res* 2010;1:54-9.
3. Saad S, Horn J. Accidental intra-arterial injection of midazolam and pethidine during endoscopy: A reminder that a routine procedure can result in disaster. *Endoscopy* 2007;39 Suppl 1:E198-9.
4. Marsch SC, Schäfer HG. An accidental intra-arterial injection of midazolam through a 3-way stopcock in an arterial flushing system. *Anaesthesist* 1990;39:337-8.
5. Fikkers BG, Wuis EW, Wijnen MH, Scheffer GJ. Intraarterial injection of anesthetic drugs. *Anesth Analg* 2006;103:792-4.
6. Reynolds LM, Lau M, Brown R, Luks A, Fisher DM. Intramuscular rocuronium in infants and children. Dose-ranging and tracheal intubating conditions. *Anesthesiology* 1996;85:231-9.
7. Vyskocil JJ, Kruse JA, Wilson RF. Techniques for vascular access when venous entry is impossible. Route depends on urgency and the agent to be administered. *J Crit Illn* 1993;8:539-45.
8. Sen S, Chini EN, Brown MJ. Complications after unintentional intra-arterial injection of drugs: Risks, outcomes, and management strategies. *Mayo Clin Proc* 2005;80:783-95.
9. Boucek CD, Abu El Magd K. Alternative route transfusion for transplantation surgery in patients lacking accessible veins. *Anesth Analg* 2006;102:1591-2.