Lidocaine is a drug that has a wide variety of uses. It can be given intravenously to stabilize a life-threatening arrhythmia. It can be given by percutaneous injection when an epidural block is needed, or it can be given as a topical solution for local or regional anesthesia.

During bronchoscopy, we use lidocaine to anesthetize the upper airway as well as the tracheobronchial tree. In our bronchoscopy suite, we give lidocaine 4 percent via a nebulizer to anesthetize the bronchus, viscous lidocaine 2 percent to anesthetize the nasal passageway, as well as lidocaine 1 percent flushed through the bronchoscope to anesthetize the area that we are evaluating. We use all of this lidocaine to help the patient tolerate the procedure with minimal discomfort and prevent the stimulation of excessive cough.

Recently, our facility's critical care pharmacist informed the bronchoscopy staff of a medication safety alert from the Institute for Safe Medication Practices (ISMP). The alert noted that complications related to lidocaine toxicity postbronchoscopy had been reported. This prompted me to evaluate the safety of our current practice.1 This article is a result of a review of current available literature. It contains a brief summary of the published information, along with a discussion of the clinical symptoms of lidocaine toxicity and the recommended treatment for this complication.

In May 2002, ISMP reported that a patient undergoing bronchoscopy was given 10 ml of 2 percent lidocaine jelly; lidocaine 4 percent was administered to the tracheobronchial tree via the bronchoscope. In all, as much as 80 ml of topical lidocaine was given. During the procedure the patient had a seizure and required intubation. He later recovered, but it was calculated that the patient received more than 3 grams of topical lidocaine. An earlier report by the ISMP noted that a 19 year-old healthy student volunteer in a research protocol was given topical lidocaine for local anesthesia. The patient was discharged after the procedure and later, at home, she suffered a seizure and died. The medical examiner confirmed that the cause of death was lidocaine toxicity.

Researchers reported in a study on asthmatics undergoing research bronchoscopy that lidocaine is rapidly absorbed from the upper airway, tracheobronchial tree and the alveoli into the bloodstream, and that peak blood concentrations are generally reached 20 to 40 minutes after the topical application, with the risk of more serious toxic effects increasing when the blood concentration exceeds 5 mg/L.2 It also reported that in some of these otherwise healthy volunteers that the lidocaine was very rapidly absorbed, reaching peak blood serum levels as soon as 15 minutes.

Another study reported that absorption of topical lidocaine by the respiratory mucosa can be rapid, and that plasma levels cannot be predicted with confidence, so in order to avoid lidocaine toxicity, administration should be carefully monitored. This article recommends that the total dose should not exceed 4-5 mg/kg.3

A third study reported that a 30-year-old patient with acquired immunodeficiency syndrome (AIDS), chronic-end stage renal failure, anemia and congestive heart failure experienced a seizure after a topical lidocaine had been used during a bronchoscopy procedure. The patient's blood serum levels at 12 hours post-procedure were 12 mg/L. This report concluded by saying that there is a direct correlation between blood serum levels and the development of clinical symptoms. The lidocaine dose should be titrated slowly, taking the patient’s weight and other debilitating illnesses into consideration. Efforts should be made to administer...
the minimum amounts of lidocaine to the respiratory system.\textsuperscript{4}

\textbf{Clinical Discussion and Nursing Care}

Lidocaine, though generally safe, effective and well-tolerated, is not without incidence. Lidocaine toxicity can and occasionally does occur following bronchoscopy. As shown in the literature, lidocaine absorption is especially rapid in the bronchial tree. Excessive doses given in short intervals can lead to dangerously high plasma levels. The recommended doses of lidocaine without epinephrine is approximately 4 mg/kg. For example, a patient weighing 70 kg should receive a maximum dose of 300 mg. If epinephrine is added, the maximum safe dose is approximately 7 mg/kg.\textsuperscript{5}

All patients undergoing bronchoscopy should have continuous monitoring of heart rate, blood pressure, oxygen saturation, respiratory status and level of consciousness, and a current weight should be available. The patient history should include any known allergies to lidocaine and a list of all currently treated medical conditions. Lidocaine, like most drugs, is metabolized by the liver and is excreted primarily by the kidneys, so any history of liver or renal failure should be given careful consideration. Patients with congestive heart failure and patients taking beta-blockers are also prone to decreased lidocaine clearance and require special consideration along with the acutely ill, the elderly and children.

The initial sign of a high plasma level of lidocaine is usually drowsiness. This sign may be difficult if not impossible to detect during bronchoscopy due to the administration of conscious sedation. However, lidocaine toxicity should be considered if a patient should be slow to recover following the procedure.

RxMed.com, an online pharmaceutical information site, notes numerous clinical symptoms. The following is a list of the most significant. The symptoms affecting the central nervous system are circumoral paresthesia, lightheadedness, apprehension, euphoria, confusion, dizziness, tinnitus, blurred vision, vomiting, feeling hot or cold, numbness, twitching, tremors, convulsions, unconsciousness and coma.

Cardiovascular symptoms include bradycardia, hypotension, arrhythmia, cardiovascular collapse and cardiac arrest. Symptoms of toxic lidocaine levels affecting the respiratory system include hyperventilation, dyspnea, hypoxia and severe apnea leading to acidosis. The development of any of these symptoms is serious and can cause the patient’s condition to rapidly deteriorate.\textsuperscript{6}

The first step in the prevention of an emergency related to bronchoscopy will always be a thorough assessment and history by the bronch lab nurse. All patients undergoing bronchoscopy will require the placement of an IV so that any needed medications can be given. The patient will also require careful continuous monitoring of the cardiovascular and respiratory vital signs. The patient’s level of consciousness should be assessed after each dose of anesthetic.

If a toxic reaction should occur, immediate attention should be given to the maintenance of the patent airway. The patient may require the placement of an endotracheal tube so that oxygen can be delivered and ventilation can be controlled. This may help to prevent convulsions if they have not already occurred. If convulsions occur, it may be necessary to give IV anticonvulsant medications such as Thiopental 100-150 mg or Valium 5-10 mg. If convulsions are difficult to control, succinylcholine will rapidly stop the muscle convulsions, but if used, endotracheal intubation with controlled ventilation will be required.

If symptoms of cardiovascular depression occur, such as bradycardia or hypotension, ephedrine 5-10 mg IV should be given and repeated as necessary after 2 to 3 minutes. If the patient’s condition deteriorates to the point of cardiopulmonary arrest, resuscitation efforts should follow indicated ACLS protocol. Maintaining optimal oxygenation and ventilation will help to prevent acidosis.

If the patient experienced the symptoms of lidocaine toxicity while still within the bronchoscopy suite, he should be transferred to a critical care area where he can be monitored for a minimum of 24 hours and perhaps longer if there are any underlying conditions that may effect the patient’s ability to clear lidocaine from his bloodstream.

Lidocaine levels should be drawn at the onset of symptoms and every 4 to 6 hours. The patient’s cardiovascular respiratory status and level of consciousness should be continually monitored. IV access
should be maintained so that emergency drugs can be given if needed. Provided that the resuscitation effort was successful, once the patient has recovered from lidocaine toxicity and all symptoms are diminished, he may be transferred from the critical care area and then eventually sent home.

**Conclusion**

Topical lidocaine used during bronchoscopy is typically safe and effective, although life threatening complications can occur. Lidocaine is rapidly absorbed through the tracheobronchial tree. The patient undergoing bronchoscopy requires a detailed nursing history and assessment. The patient should be continually monitored for any clinical symptoms of lidocaine toxicity. Monitoring includes heart rate, blood pressure, respiratory status, oxygen saturation and level of consciousness while taking into account any sedation that may have been given.

Any change in the patient’s assessment should be responded to immediately. The role of the bronchoscopy nurse is essential in the prevention of lidocaine toxicity and for immediate care of the patient who is experiencing it.

In our facility, we have adopted the practice of using only as much lidocaine as necessary, with a maximum dose of 4 mg/kg. If the patient is experiencing excessive cough, we titrate the IV sedation to help in reducing it.

All of our patients are continually monitored during the procedure. After the procedure, they are monitored for a minimum of 30 minutes in the bronch lab by the bronchoscopy staff. If the patient is stable and symptom-free he is transferred to an extended recovery area. If the patient has been admitted to the hospital, he will return to his room. In both cases, the patient’s vital signs are monitored frequently for the next two hours. All outpatients must have a responsible adult who will stay with them for the next 24 hours, and all patients are given an emergency phone number should a problem occur.

Endoscopy nursing is interesting and enjoyable especially when it is done safely and with the best interest of the patient in mind.

*Cynthia R. King, RN, BSN, CCRN, has worked at the Nashville VA Medical Center for 10 years. She has worked eight years in the MICU and the last two in the endoscopy lab.*

**Works Cited**


2. Langmack, MD; Martin, MD, FCCP; Pak BS; and Kraft, MD FCCP. *Serum Lidocaine Concentrations in Asthmatics Undergoing Research Bronchoscopy* Chest /117/4/April 2000.


