Epinephrine-induced potentially lethal arrhythmia during arthroscopic shoulder surgery: A case report

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Arthroscopic shoulder surgery performed on a healthy female could have resulted in a fatal outcome when the epinephrine present in the arthroscopic irrigating solution contributed to the onset of ventricular tachycardia requiring defibrillation during surgery.

During this procedure, the shoulder was infiltrated with 30 mL of a 1:100,000 solution of epinephrine into the subacromial space and glenohumeral joint. Subsequently, instrumentation of the glenohumeral joint by the orthopedic surgeon with a standard arthroscopy trocar resulted in a 0.5-cm size lesion to the posterior humeral cortex. Minutes after the start of the surgical procedure, the patient displayed an abrupt onset of ventricular tachycardia and hypertension. These signs and symptoms suggested an intraosseous infusion of both infiltrated and irrigation solution containing epinephrine through the lesion in the humeral cortex. Approximately 800 mL of a .01 mg/mL concentration of irrigation solution containing epinephrine was used.

A diagnosis of epinephrine-induced ventricular tachycardia was made. The arthroscopic irrigating solution was immediately discontinued and lidocaine, 100 mg intravenously, was administered; however, the patient's cardiac rhythm degenerated into a sustained ventricular tachycardia that was unresponsive to pharmacologic intervention.

A full code was called; the surgeon, anesthesia team, and operating room personnel successfully provided advanced cardiac life support and cardioverted the patient back into a sinus rhythm with no untoward effects.

Key words: Arthroscopic shoulder surgery, defibrillation, intraosseous infusion, trocar instrumentation.

Introduction
A 52-year-old woman presented as a same-day admission for an elective arthroscopic decompression and manipulation of the left shoulder under general anesthesia.

Preoperative assessment revealed a 79 kg, 5 feet, 6 inch tall female, ASA physical status I, with no significant medical history. Surgical history included tonsillectomy, cholecystectomy, appendectomy, and hysterectomy with no untoward events. A normal sinus rhythm at 73 beats per minute was shown on the electrocardiogram. Laboratory values included a hemoglobin level of 13.1 g/dL and hematocrit of 39.6%.

Routine monitors, including a pulse oximeter, noninvasive blood pressure cuff, lead II electrocardiogram, skin temperature probe and oxygen/end-tidal CO₂ agent analyzer were activated. An 18-gauge intravenous (IV) cannula was in situ from the short stay unit. After preoxygenation for 3 minutes, an IV induction including midazolam, 2 mg;
fentanyl, 150 μg, followed by propofol, 200 mg; and atracurium, 35 mg; preceded an uneventful intubation with a 7.5-mm internal diameter endotracheal tube. Anesthesia was maintained with isoflurane, nitrous oxide, and oxygen. The patient was placed in the right lateral decubitus position with appropriate padding and supportive devices.

Vital signs remained stable prior to surgery (blood pressure 138/62 mm Hg; heart rate 76 beats per minute), but the patient experienced an abrupt increase in heart rate to 120 beats per minute soon after the start of the surgical procedure. These signs were initially considered to be “light” anesthesia, fentanyl 100 μg was administered IV, and the concentration of isoflurane was increased.

Subsequently, the patient’s heart rate further increased to 170 beats per minute, the blood pressure increased to 212/118 mm Hg, and a differential diagnosis of epinephrine-induced ventricular tachycardia was made. The arthroscopic irrigating solution containing the epinephrine was immediately discontinued along with the isoflurane. The patient was placed on 100% oxygen and the surgical procedure was discontinued at this time.

Pharmacologic intervention consisted of lidocaine, 100 mg IV. The patient was unresponsive to the initial bolus of lidocaine, and her cardiac rhythm degenerated into a sustained ventricular tachycardia. As a result, a second bolus of lidocaine, 100 mg IV, was administered and a full code was implemented with the patient being placed in the supine position. At this time, no peripheral pulses were palpable, so cardiopulmonary resuscitation was initiated to maintain vital organ perfusion.

Immediately upon arrival of the defibrillator, monitor leads were attached and defibrillation pads were placed, with the patient undergoing immediate defibrillation at 200 J according to advanced cardiac life support protocol (Table). Following defibrillation, the electrocardiograph monitor revealed a wide complex tachycardia resembling torsades de pointes. As a result, a third bolus of lidocaine, 100 mg IV, was administered, and the patient again underwent defibrillation at 200 J. This measure temporarily resulted in the restoration of the patient’s cardiac rhythm to a sinus tachycardia at 140 beats per minute with a palpable pulse; however, the rhythm was unsustained and degenerated once again, this time into ventricular fibrillation.

With the onset of ventricular fibrillation, cardiopulmonary resuscitation continued, and the patient underwent defibrillation at 300 J. This action resulted in restoring the patient’s cardiac rhythm to a sustained sinus tachycardia at 120 beats per minute and a blood pressure of 180/88 mm Hg. Magnesium, 2 g, was given intravenously at this time in an attempt to suppress any refractory runs of torsades de pointes. Vital signs remained stable with monitors showing a normal sinus rhythm at 89 beats per minute, SpO₂ 99%, and blood pressure 144/82 mm Hg.

Immediately upon stabilization of the patient’s cardiac rhythm the patient was assessed for the degree of neuromuscular blockade and was given a reversal dose of neostigmine, 2 mg, and glycopyrrolate, 0.4 mg IV. The oropharynx was suctioned and spontaneous ventilation resumed shortly thereafter, with the patient responding appropriately to verbal commands. Extubation proceeded without incident, and the patient was transferred to the intensive care unit for monitoring.

Upon admission to the intensive care unit, serial electrocardiograms, enzymes, and electrolytes were drawn. Abnormal findings revealed a potassium of 2.9 mEq/L and the development of a new right bundle and left anterior fascicular block when compared to the patient’s preoperative electrocardiogram. Cardiac enzymes ruled the patient out for the occurrence of a myocardial infarction. Subsequently, the patient received potassium supplementation, and a bedside echocardiogram revealed an adequate left ventricular contraction pattern and

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**Table.** Cardiopulmonary resuscitation and advanced cardiac life support protocol—V-fibrillation/pulseless V-tachycardia algorithm*

<table>
<thead>
<tr>
<th>Step</th>
<th>Action</th>
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<tbody>
<tr>
<td>1.</td>
<td>Airway, breathing, and circulation (ABCs)</td>
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<tr>
<td>2.</td>
<td>Cardiopulmonary resuscitation (CPR) until defibrillator is available</td>
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<tr>
<td>3.</td>
<td>Defibrillate</td>
</tr>
<tr>
<td>A.</td>
<td>200 J (unsynchronized)</td>
</tr>
<tr>
<td>B.</td>
<td>200-300 J (unsynchronized)</td>
</tr>
<tr>
<td>C.</td>
<td>360 J (unsynchronized)</td>
</tr>
<tr>
<td>4.</td>
<td>CPR, start large-bore intravenous (IV), intubate</td>
</tr>
<tr>
<td>5.</td>
<td>Epinephrine 1:10,000 - 1.0 mg IV push, repeat every 3-5 minutes</td>
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<tr>
<td>6.</td>
<td>Defibrillate 360 J (unsynchronized)</td>
</tr>
<tr>
<td>7.</td>
<td>Lidocaine 1.5 mg/kg IV push, repeat every 3-5 minutes to a loading dose of 3 mg/kg; then use:</td>
</tr>
<tr>
<td>A.</td>
<td>Bretylium, 5 mg/kg IV, repeat with 10 mg/kg every 15-30 minutes to a total of 30 mg/kg</td>
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<tr>
<td>B.</td>
<td>Magnesium sulfate 1-2 grams IV in torsades de pointes or suspected hypomagnesemic state or severe refractory ventricular fibrillation</td>
</tr>
<tr>
<td>8.</td>
<td>Consider bicarbonate 1 mEq/kg (if known preexisting bicarbonate responsive acidosis, prolonged arrest, hypoxic lactic acidosis, or tricyclic antidepressant overdose)</td>
</tr>
</tbody>
</table>

*Epinephrine was deleted from the above algorithm.
ejection fraction. Follow-up electrocardiograms showed a gradual return to the patient's preoperative baseline status, and the patient was discharged from the hospital within 48 hours.

Arthroscopic surgeries for various types of procedures are being performed on a routine basis in the operating room. With this in mind, it is imperative that anesthetists know the adjunctive drugs being used in conjunction with these procedures, as well as the potential complications that may arise. In addition, anesthetists must possess the knowledge and skills necessary to appropriately intervene in a resuscitative effort so they can quickly respond to life-threatening situations.

SUGGESTED READING


AUTHOR

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