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CASE REPORT

Anesthetic management of patient with hypertrophic cardiomyopathy and automatic implantable cardioverter defibrillator with a hand fracture

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Abstract

A 26-year-old male with a history of hypertrophic cardiomyopathy (HCM) and ventricular arrhythmias s/p automatic implantable cardioverter defibrillator (AICD) placement presented for open reduction and internal fixation of an open third metacarpal fracture and extensor tendon repair. He underwent successful surgery after placement of an ultrasound-guided infraclavicular brachial plexus block with ropivacaine 0.5% as the main anesthetic. This case report discusses the anesthetic management of patients with HCM and AICD, different approaches available for brachial plexus blockade, and potential complications of anesthesia and surgery in this group of patients.

Key words: Hypertrophic cardiomyopathy; Automatic implantable cardioverter defibrillator; Brachial plexus block; Hand fracture; Ropivacaine

Core tip: The anesthetic management of patients with hypertrophic cardiomyopathy (HCM) and automatic implantable cardioverter defibrillator (AICD) can be very challenging. We present a case of a 26-year-old male who presented for open reduction and internal fixation of an open right hand fracture. He underwent successful surgery after placement of an ultrasound-guided infraclavicular brachial plexus block with ropivacaine 0.5% as the main anesthetic.

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INTRODUCTION

The anesthetic management of patients with hypertrophic cardiomyopathy (HCM) and automatic implantable cardioverter defibrillator (AICD) can be very challenging. We present a case of a 26-year-old male who presented for open reduction and internal fixation (ORIF) of an open right hand fracture. We discuss anesthetic implications of patients with HCM and AICD, different approaches to brachial plexus blockade, and potential risks and complications pertinent to this group of patients.

CASE REPORT

A 26-year-old Caucasian male, 70 inches tall and weighing 105 kg, presented for incision and drainage, ORIF of an open right third metacarpal fracture, and extensor tendon repair after injuring his hand at home while fixing his garage door. He had a history of hypertrophic cardiomyopathy and ventricular arrhythmias s/p insertion of an automatic implantable cardioverter defibrillator two years ago. His vital signs were a blood pressure of 99/50 mmHg, heart rate of 50, respirations of 16 per minute, and oxygen saturation of 99% on room air. Electrocar-

diogram showed sinus bradycardia (HR 54) with sinus arrhythmia and occasional premature ventricular contractions. His preoperative hemoglobin and hematocrit were 15.0 and 42.6 g/dL, respectively, and his electrolytes were normal. His physical examination was otherwise normal. At home the patient took metoprolol 100 mg by mouth once a day. The patient reported that the AICD had discharged twice in the past year during periods of increased physical activity. He did not have any problems with normal physical activity and denied chest pain or shortness of breath on exertion. He denied additional medical history and had never undergone an anesthetic.

After discussion with the patient and his family, the decision was made to perform a brachial plexus block. The AICD was interrogated by the company representative and found to be working properly. We proceeded by performing a right ultrasound-guided infraclavicular brachial plexus block with 40 mL of ropivacaine 0.5% without the use of a nerve stimulator.

Once in the operating room, adhesive external defibrillating pads were placed and the AICD device was turned off due to the expected use of electrocautery during surgery. The patient underwent successful surgery with the brachial plexus block as the main anesthetic and light sedation. Of note, his electrocardiography (ECG) showed premature ventricular contractions throughout the procedure but his hemodynamics were stable throughout. The AICD device was turned back on after the procedure was finished. He recovered well and was discharged home the next morning.

DISCUSSION

This was a challenging case due to the following factors: management of a patient with hypertrophic cardiomyopathy, management of a patient with an AICD *in situ*, the risks of using of peripheral nerve stimulation for performance of a nerve block in patients with AICD, and potential effects on the cardiovascular system of brachial plexus blockade. Careful consideration of each issue separately was important in avoiding complications in this patient. These issues are addressed separately below.

HCM

HCM is a genetic cardiac disorder that is the most common cause of sudden cardiac death in the young[1]. It is characterized by heterogeneous left ventricular hypertrophy and patients often present with diastolic dysfunction that is reflected by elevated left ventricular end-diastolic pressures in spite of often hyperdynamic ventricular function. Clinical course is determined by the following factors: dynamic obstruction to left ventricular outflow, diastolic dysfunction, impaired coronary vasodilator reserve and myocardial ischemia, and supraventricular and ventricular arrhythmias[2]. Anesthetic goals for these patients are: minimize sympathetic activation, expand intravascular volume in order to avoid hypovolemia, and minimize decreases in left ventricular afterload. Reported adverse events for patients with HCM undergoing noncardiac surgery include: congestive heart failure, hypotension, arrhythmias, and myocardial infarction[3].

Our patient had a history of arrhythmias for which he had the AICD placed previously. His electrocardiogram showed sinus arrhythmia and occasional premature ventricular contractions which were concerning. He did not have any history of chest pain and was able to do normal daily activities and work without limitation. The biggest concern was that both episodes where his AICD had discharged previously took place during periods of increased stress and excitement. We all agreed that avoiding a general anesthetic was the best course of action in this case.

AICD

Patients presenting for noncardiac surgery with AICD *in situ* are becoming more common every day. During surgery, the AICD should be deactivated in order to avoid accidental discharge or damage to the device cause by electrocautery or any device that generates a pulse current, including peripheral nerve stimulators[4]. Other patient factors may affect the function of an AICD. Electrolyte abnormalities may cause the actions of an AICD to fail. In addition, patient positioning, positive pressure ventilation, and shivering may affect the functionality of the AICD.

It is important to place external defibrillating pads on the patient while the device is turned off. In our patient, we first applied the external defibrillating pads and turned on the monitoring function of the external defibrillating device. Then, we turned off the AICD device immediately before surgery. Once surgery was finished, we turned the AICD back on and it was found to be functioning properly.

Peripheral nerve stimulation and AICD

Once the decision was made to perform a brachial plexus block in this patient, we needed to take into consideration the potential effects of a nerve stimulator on the AICD device. Manickam *et al*[5] described a set of recommendations with regards to the use of peripheral nerve stimulation in patients with pacemakers. The same issues apply to AICD. If stimulation cannot be avoided, the ground electrode should be placed as far away as possible from the device and stimulation should be done well away from the device (at least 6 inches). Stimulating pulses should be no more than 0.2 milliseconds in duration and the rate of stimulation should not be faster than 1 Hz[5].

Although the surgery and nerve block were to be performed on the right side, away from the AICD, it was decided that it would be best to avoid the use of peripheral nerve stimulation if possible. With the assistance of ultrasound, we were able to visualize the structures and place the local anesthetic around the nerves to provide a surgical block while avoiding the use of nerve stimulation.

Stellate ganglion block after brachial plexus block

Stellate ganglion block is a technique used to diagnose and treat complex regional pain syndrome of the upper extremity. It is performed by local anesthetic injection around the sympathetic chain at the C6 level. Inadvertent blockade of the stellate ganglion may occur during blockade of the brachial plexus and the most common clinical presentation is Horner's syndrome. Horner's syndrome presents as ptosis, miosis and anhidrosis of the ipsilateral face. This commonly resolves within a couple of hours without clinical significance. Reassurance of the patients is all that is needed. A recent study by Tran *et al*[6] found the incidence of Horner's syndrome in ultrasound-guided supraclavicular blocks to be 37%, compared to 5% for infraclavicular and 0% for axillary blocks. However, a report on 510 consecutive ultrasound-guided supraclavicular blocks showed an incidence of Horner's of only 1%[7]. All in all, the more distal blocks have less incidence of this side effect.

Fujiki *et al*[8] studied hemodynamic effects of stellate ganglion block on healthy volunteers. They found that: (1) autonomic innervation of the sinus node is mainly through the right-sided stellate ganglion; (2) pharmacologic right-sided stellate ganglion block may attenuate not only sympathetic but also parasympathetic activity; and (3) following right stellate ganglion block the decrease in both the sympathetic and parasympathetic influence on the sinus node may inconsistently counterbalance and change the RR interval. Left-sided stellate ganglion block changed none of the heart rate variability indices studied.

Although the effects of stellate ganglion blockade on heart rate and electrical conduction may be clinically insignificant in healthy patients, these effects could potentially be detrimental in patients with cardiac disease, especially with history of arrhythmias. Therefore, it is probably best to avoid this side effect in patients with cardiac disease.

We chose an ultrasound-guided infraclavicular block due to our familiarity and success with the technique. Both a supraclavicular and an axillary block would also have been adequate for this surgical procedure. Since the surgery was on the right arm, opposite the AICD device, we were not as concerned with the needle insertion site. If the patient had needed surgery on his left arm, an ultrasound-guided axillary block would have been our choice, as we would want to avoid nerve stimulation and needle placement anywhere near the chest.

In conclusion, a patient with HCM and AICD who required an anesthetic for repair of this hand was successfully managed by placement of an ultrasound-guided brachial plexus nerve block. Consideration of the multiple issues which may arise is important in the management of these patients. Patients presenting for surgery with these medical problems are becoming more and more common. Special consideration should be taken regarding the method of nerve block placement in patient with an AICD in place. Potential hemodynamic effects of anesthetic techniques in patients with HCM and AICD should be considered at all times. Future studies should look at which anesthetic techniques best maintain hemodynamics in patients with HCM and AICD undergoing a variety of surgical procedures.

REFERENCES

1 **Maron BJ**. Hypertrophic cardiomyopathy: a systematic review. *JAMA* 2002; **287**: 1308-1320 [PMID: 11886323 DOI: 10.1001/jama.287.10.1308]

2 **Poliac LC**, Barron ME, Maron BJ. Hypertrophic cardiomyopathy. *Anesthesiology* 2006; **104**: 183-192 [PMID: 16394705 DOI: 10.1097/00000542-200601000-00025]

3 **Haering JM**, Comunale ME, Parker RA, Lowenstein E, Douglas PS, Krumholz HM, Manning WJ. Cardiac risk of noncardiac surgery in patients with asymmetric septal hypertrophy. *Anesthesiology* 1996; **85**: 254-259 [PMID: 8712439 DOI: 10.1097/00000542-199608000-00005]

4 **Takeuchi M**, Iwasaki T, Oue T, Taga N, Toda Y, Oe K, Morita K. Anesthetic management of a patient with severe dilated cardiomyopathy and an automatic implantable cardioverter-defibrillator (AICD) during total gastrectomy. *J Anesth* 2005; **19**: 81-83 [PMID: 15674523 DOI: 10.1007/s00540-004-0283-z]

5 **Manickam BP**, Brull R. Implications of a permanent cardiac pacemaker in peripheral nerve blockade. *Reg Anesth Pain Med* 2009; **34**: 233-235 [PMID: 19587621 DOI: 10.1097/AAP.0b013e31819a8a81]

6 **Tran de QH**, Russo G, Muñoz L, Zaouter C, Finlayson RJ. A prospective, randomized comparison between ultrasound-guided supraclavicular, infraclavicular, and axillary brachial plexus blocks. *Reg Anesth Pain Med* 2009; **34**: 366-371 [PMID: 19574871 DOI: 10.1097/AAP.0b013e3181ac7d18]

7 **Perlas A**, Lobo G, Lo N, Brull R, Chan VW, Karkhanis R. Ultrasound-guided supraclavicular block: outcome of 510 consecutive cases. *Reg Anesth Pain Med* 2009; **34**: 171-176 [PMID: 19282715 DOI: 10.1097/AAP.0b013e31819a3f81]

8 **Fujiki A**, Masuda A, Inoue H. Effects of unilateral stellate ganglion block on the spectral characteristics of heart rate variability. *Jpn Circ J* 1999; **63**: 854-858 [PMID: 10598890 DOI: 10.1253/jcj.63.854]

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