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The occasional electrical cardioversion

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Introduction

Treating patients who present with arrhythmia is a common problem for the rural physician. Although many patients are easily managed with antiarrhythmic agents, some require electrical cardioversion. Direct current applied through the chest wall is an effective means of normalizing many dysrhythmias, and there are infrequent side effects if this procedure is used appropriately.

Indications

- First-line treatment for unstable tachydysrhythmias.
- Treatment of stable tachycardias refractory to medication.
- Treatment of atrial fibrillation and atrial flutter.

Electrical cardioversion/defibrillation is also essential in the management of pulseless ventricular tachycardia and ventricular fibrillation. Treatment of these cardiac arrest rhythms is beyond the scope of this article and is better covered through an Advanced Cardiac Life Support (ACLS) course.

Unstable tachydysrhythmias

A pulse rate > 150 beats/min with altered mentation, hypotension, respiratory difficulty or chest pain suggests an unstable tachycardia. Urgent electrical cardioversion is indicated, although a brief trial of medications may be appropriate.

Stable tachycardias

Current ACLS guidelines recommend electrical cardioversion for stable tachycardias if drug treatment has failed.1 Significant risks of hemodynamic compromise exist if antiarrhythmic agents are combined, therefore electrical cardioversion is generally appropriate after the failure of a single agent. The common exception to this is the use of verapamil when adenosine has been unsuccessful in the treatment of paroxysmal supraventricular tachycardia.

Atrial fibrillation / flutter

Patients with recent onset of atrial fibrillation (< 48 h) are candidates for electrical or pharmacological cardioversion.

However, if it has been more than 48 hours since onset of atrial fibrillation, a clot may form in the left atrium, and cardioversion, whether spontaneous, electrical or pharmacological, may provoke a cerebrovascular accident or femoral embolus. These patients require medication for rate control and adequate anticoagulation for a minimum of 3 weeks prior to cardioversion. Anticoagulation should continue for a further 4 weeks after restoration of sinus rhythm, until the risk of embolization has normalized.2

Atrial flutter tends to be resistant to drug therapy, so early electrical cardioversion is appropriate. Patients with atrial flutter often have periods of undetected atrial fibrillation, therefore I recommend the same anticoagulation precautions as for atrial fibrillation.2

Contraindications

- Atrial fibrillation > 48 h duration unless anticoagulated for 3 weeks.
- Digoxin-related dysrhythmias.
- Conditions where the rhythm disturbance is not the primary problem. Rhythms such as multifocal atrial tachycardia and rapid atrial fibrillation may be a response to respiratory failure, where management of the underlying condition is the key to successful treatment.

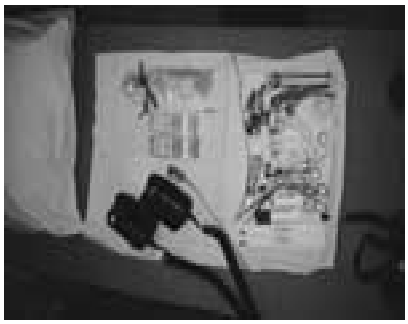
Procedure

For elective procedures the patient should be fasting to minimize the risk of

aspiration. Ideally, I prefer a second physician in attendance to deal with conscious sedation or anesthesia, allowing me to concentrate on the cardioversion. Failing that, a nurse, respiratory therapist or paramedic should be available to manage the patient's airway.

Step 1

Equipment: high-flow oxygen, suction, ECG monitor and defibrillator, oxygen saturation monitor, ACLS drugs and intubation equipment (Fig. 1).



Step 2

IV line (18–20G), administer oxygen, attach cardiac monitor leads and oxygen saturation monitor, place gel pads on chest. One pad should be placed below the clavicle just to the right of the upper sternum. The second pad is located in the mid-axillary line lateral to the nipple (Fig. 2).

Step 3 Intravenous sedation with midazolam (0.05–0.15 mg/kg) + fentanyl (1.0–1.5 mcg/kg). Use a lower dose if the patient is unstable or elderly.

Step 4

Press "Synch" button to synchronize shock with R-wave (Fig. 3).

Step 5

Ensure that R-wave markers appear on the monitor (Fig. 4).

Step 6

When appropriate level of sedation occurs, warn team that you are about to charge the cardioverter.

Step 7

Select initial energy level and press "Charge."

- Supraventricular tachycardia, atrial flutter: 50 J
- Atrial fibrillation, ventricular tachycardia: 100 J

Step 8

Place paddles on gel pads and apply 10-kg pressure (Fig. 5).

Step 9

Ensure all personnel are clear by giving a verbal warning. Press the "Discharge" buttons on both paddles. Maintain paddle pressure until shock occurs.

Step 10

Check monitor. If rhythm unchanged, repeat process with higher energy level (up to 360 J). The "Synch" button must be pressed again because the machine will default to unsynchronized mode.

Step 11

If sinus rhythm is restored, check patient's condition and monitor until patient is stable.

Notes

Other sedation techniques or general anesthesia may be appropriate.

I find it easiest to stand on a small stool at the patient's left side, with the monitor opposite (Fig. 6). This allows me to see the monitor without turning and avoids the necessity of leaning closely over the patient with the paddles. In synchronized mode there may be a significant delay before discharge; maintain the paddle pressure until the shock occurs.

Many monitors allow a hands-free cardioversion option. Special electrode pads are applied at the same site as the gel pads (Fig. 7).

Charging and discharging are controlled on the monitor panel. The electrode pads ensure good electrical contact and reduce the risk of patient burn. They also allow repeated shocks at short intervals. It is vital to use a "clearing chant" with this technique, as it is not obvious to the rest of the medical team when the shock will occur.

Complications

Significant complications are uncommon. A recent series showed no complications in a group of 80 patients with recent onset of atrial fibrillation treated with electrical cardioversion in the emergency department.3

Hypoxia or hypotension

The effects of sedation can be minimized with conservative dosing regimes and reversed with flumazenil and naloxone if necessary.

Local burns

If the paddle slips off the gel pad or arcing occurs, local burns may develop. Paddles must be placed away from medication patches or ointment. Pacemakers and implantable defibrillators should also be avoided. Burn injury to the medical team may also occur with inadvertent patient or equipment contact.

Arrhythmias

All types of arrhythmia have occurred after electrical cardioversion. Although serious rhythm disturbances are rare, rural physicians must be prepared to manage potentially lethal arrhythmias, including ventricular fibrillation or severe bradyarrhythmias, which require temporary pacing. Inadvertent administration of an unsynchronized shock may result in the "R on T" phenomenon, provoking ventricular fibrillation. Serious post-shock arrhythmias are more common with digoxin toxicity, so I discontinue digoxin 24 h before an elective procedure.

Thromboembolism

Historical series suggest a risk of thromboembolism of 1%–5% following cardioversion for atrial fibrillation prior to current anticoagulation practices. With appropriate anticoagulation the risk appears to be closer to 1%.2

This article has been peer reviewed.

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