New Treatment of Atrial Fibrillation

THE EMERGENCY DEPARTMENT therapy for atrial fibrillation and in particular atrial fibrillation with concurrent congestive heart failure has undergone substantial change in the past few years. It is one of the most common arrhythmias emergency physicians encounter. Atrial fibrillation results in a chaotic and ineffectual contraction of the atrium that in turn produces irregular and frequently rapid ventricular contraction. Rapid, irregular ventricular contraction reduces effective diastolic filling and cardiac output. Atrial fibrillation and congestive heart failure often coexist, and one disorder can precipitate the other. Left atrial dilatation associated with congestive heart failure can result in atrial fibrillation. In patients with controlled heart failure, the onset of atrial fibrillation can reduce diastolic filling sufficiently to tip the patient into moderate or severe failure. The combination of rapid atrial fibrillation and congestive heart failure presents a management challenge.

Regardless of the cause of the fibrillation, the emergency management aim is usually the same: control the rate. Rate control improves diastolic filling and cardiac output. Digoxin has been used in the past for rate control in stable patients. But whereas digoxin has the advantage of being a positive inotrope, it has a slow onset of action. In an unstable patient, cardioversion has been the preferred option. Conversion to sinus rhythm in an emergency department is not usually the therapeutic goal for three reasons: First, in many patients the goal is not attainable. Second, after about three days of atrial fibrillation, an intra-atrial thrombus can form. Conversion to sinus rhythm without previous anticoagulation may result in thromboembolism. Third, rate control alone is sufficient to improve hemodynamics.

Rate control in patients with atrial fibrillation can be achieved rapidly with the calcium channel blockers, which act by slowing atrioventricular (AV) nodal conduction. Verapamil has been used to slow rapid atrial fibrillation but causes vasodilation and is a negative inotrope. Verapamil can precipitate deterioration or even hypotension in patients with congestive heart failure. Diltiazem is a newer calcium channel blocker that has substantial advantages over verapamil in the treatment of rapid atrial fibrillation. Diltiazem has similar effects on the AV node as verapamil, but has less negative inotropy and peripheral vasodilatory effects.

Several studies have confirmed the safety and efficacy of the use of diltiazem in patients with congestive heart failure with atrial fibrillation or flutter. Intravenous diltiazem can be safely used in most patients with rapid atrial fibrillation who are not hypotensive, and it has the advantage of a short duration of effect and relatively little negative inotropy. An initial bolus of 20 mg (or 0.25 mg per kg), followed by a continuous infusion (usually started at 10 mg per hour) often leads to smooth rate control in a time-frame suitable for emergency medicine. Studies of intravenous diltiazem use in patients with rapid atrial fibrillation and heart failure have shown improvements in cardiac output and stroke volume, with concomitant decreases in systolic blood pressure, systemic vascular resistance, and heart rate. The pulmonary capillary wedge pressure usually remains unchanged. Disadvantages to intravenous diltiazem use include a small but notable risk of hypotension, particularly in those patients with low cardiac outputs, and a relatively high cost—especially considering the need for a coronary care unit bed in a patient who might otherwise be admitted to a telemetry unit.

Combination therapy with the β-blocker esmolol hydrochloride and digoxin is another approach to achieving prompt rate control of atrial fibrillation in an emergency department. The premise of combination therapy is to use a rapidly acting agent to gain rate control while giving the patient digoxin, a slower but longer-acting agent. β-Blockers slow the ventricular response in atrial fibrillation but have the disadvantage of negative inotropy. Esmolol overcomes some of the limitations of other β-blockers because it is ultrashort-acting and therefore allows intravenous titration and rapid resolution of effect if hypotension ensues.

Further study validating the safety and efficacy of this approach will be necessary before it can be recommended for general use. Its use has been limited primarily to patients with thyrotoxicosis who are often refractory to more conventional means of treatment.

Digoxin can now be used in combination with intravenous magnesium for rapid rate control. An initial loading dose of 2 grams of magnesium sulfate (given over 15 minutes) is followed by 0.5 mg of digoxin intravenously and a continuous infusion of magnesium (1 gram per hour for 4 hours). This regimen achieves excellent rate control for most patients within two to four hours. Magnesium is relatively inexpensive and would be particularly attractive for those patients at risk for magnesium depletion, such as those with alcoholism or patients taking diuretics. There are, however, rare reports of long pauses when high doses (10 grams or more) are given. The use of magnesium is contraindicated in patients with renal insufficiency.

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Automobile Restraint Systems and Injury Prevention

DESPITE THE FACT THAT emergency physicians see people every day who have been injured in motor vehicle

accidents (MVAs), driving a car is becoming safer all the time. Fatality rates have been falling steadily for several decades due to many factors. Improvements have occurred in road design, education, and automobile design features that absorb the energy of collisions, such as collapsible steering columns, padded dashes, crumple zones, and laminated glass. None of these factors has had more effect on safety than restraint systems, which reduce the risk of ejection and lessen collisions between the occupant and the interior of the vehicle.

Seat belts have been available in automobiles since the 1950s, but did not achieve majority usage rates until states started imposing mandatory seat-belt use in the 1970s and 1980s. Currently 48 states have mandatory seat-belt laws, and all 50 states require child safety seats. Belt usage rates soared from about 10% in the 1970s to the current estimates of 67% nationwide and 83% in California. The National Highway Traffic Safety Administration estimates that a three-point seat belt alone reduces fatalities by 45%, and if an air bag is also present, there is an additional 10% reduction in fatalities. Drivers must be cautioned, however, that air bags used without seat belts are insufficient protection because they offer little protection in lateral collisions and do not prevent ejection. Since 1990 the requirements for United States-produced passenger cars include automatic restraints for the front seat (air bags or automatic belts) and three-point belts (lap and shoulder) for the back seat. By the 1998 model year, driver and front-seat-passenger air bags will be required on all new cars, along with manual lap and shoulder belts in the front and rear seats.

Seat belts and air bags alter the distribution of injuries produced in MVAs, and they even cause some injuries of their own. These injuries depend on the configuration of the belt system. For example, the classic "seat-belt syndrome" of a lumbar "chance" fracture and intestinal injury is caused by a lap belt riding up onto the abdomen of the occupant during sudden deceleration. Although air bags have caused some serious injuries such as ocular trauma and atrial rupture, most are less severe and include abrasions to the face, chest, and arms. Manufacturers are attempting to improve air bag materials so that they are lighter, more compact, and less abrasive.

Some problem areas persist for restraint systems. Children who are too large for protective child safety seats but too small to properly fit into seat belts designed for adults are at risk. Many manufacturers have introduced shoulder belts with adjustable anchors to combat this problem. The lateral collision is also a particular problem because there is less room to absorb the collision energy before it reaches the occupant(s).

No discussion of injury prevention in MVAs would be complete without mentioning the effects of alcohol use. Alcohol use is involved in 48% of fatal MVAs. A third of the drivers between the ages of 21 and 29 who are involved in a fatal accident are intoxicated. Although the number of alcohol-related fatalities in MVAs is slowly falling, large reductions in morbidity and mortality could be achieved by further reductions in the prevalence of drunk driving. Regardless of how effective restraint systems may become, the best way to prevent injuries is to prevent accidents.

We should be optimistic that advances in vehicle safety will continue to reduce the number and extent of injuries, and we should encourage our patients and their children to buckle up. We also need to continue to educate people not to drink and drive.

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Use of Ultrashort-Acting Hypnotic Agents in Emergency Departments

EMERGENCY PHYSICIANS are faced with myriad reasons to use anesthetic agents in the course of practice. Often there is a need to do painful procedures in an emergency department for diagnosis and treatment, such as minor surgical or orthopedic procedures or endotracheal intubation. Sometimes the need is for sedation alone. A new approach to inducing unconsciousness rapidly in patients is the use of ultrashort-acting sedative-hypnotic agents, such as propofol, etomidate, and methohexital sodium. The ideal agent should have a quick onset of action, a duration sufficient for the procedure, and a rapid recovery profile with minimal side effects. All three drugs share similar features of rapid onset and recovery, but each produces some degree of cardiorespiratory depression. Careful monitoring of oxygenation, ventilation, and circulation is mandatory. These drugs alone do not provide analgesia or neuromuscular blockade, so other drugs should be administered for those purposes. The concomitant administration of narcotics and hypnotics may increase the incidence and severity of side effects.

Propofol is a phenol derivative prepared in a solution of 10% soybean oil and 1.2% egg phosphatide (Intralipid). Administering propofol intravenously (2.0 to 2.5 mg per kg of body weight) produces unconsciousness within 30 seconds. Lower doses can be used for sedation for various procedures, either by small boluses (0.2 to 0.4 mg per kg) or by infusion. Patients awaken more rapidly and completely than after other induction agents, usually in several minutes. These properties make propofol especially suitable for patients who are expected to be discharged after the procedure is completed. Propofol reduces the cerebral metabolic rate for oxygen and has been used to treat refractory status epilepticus. Cardiovascular depression, as evidenced by decreases in blood pressure (without a change in the heart rate), is greatest with the use of propofol and may be exaggerated