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Management of Injured Cardiac Patients with Pacemaker and Implanted Defibrillator, a Call for Aggressive Utilization of Memory Function

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Abstract

Increased use of pacemakers (PM) and implantable cardioverter-defibrillator devices (ICD) in patients with cardiac diseases has paralleled a rise in the number of injured patients presenting to trauma centers with these devices in place. PMs and ICDs store telemetric cardiac data for varying lengths of time, but typically up to or greater than six months, and retrieval of this information after injury is necessary for the complete care of injured cardiac patients. These data may yield critical insight as to a cardiac etiology or device failure that may have been the cause of the injury or resulted from injury. Furthermore, trauma can damage the device itself leading to additional cardiac complications. All of this information can only be discovered by interrogation of the device. We surveyed trauma surgeons who are members of Eastern Association for the Surgery of Trauma (EAST). We found significant underutilization of this resource in the total care of the injured cardiac patient. Because of the importance of this information we advocate for more aggressive retrieval of telemetric data stored in these devices.

Introduction

Demographic studies of the aging population in the US have demonstrated an increased use of pacemakers (PM) and implantable cardioverter-defibrillator devices (ICD) in patients with cardiac diseases. The 11th World Survey of Cardiac Pacing and Implantable Cardioverter-Defibrillators found the US to be the largest consumer of these devices with 235,567 new pacemaker implants in 2009 alone (up from 223,425 in 2005) and 133,262 de novo ICD implants (up from 119,121) [1] with increasing utilization of these devices there has been a concomitant increase in the number of trauma patients presenting with PM or ICD implants. Routine interrogation of these implantable rhythm control devices provides valuable telemetric information regarding the cardiac status of the trauma patient before, during and after the injury. This information has implications for both diagnosis and treatment and therefore surgeon familiarity with their identification and management is of paramount importance. Although devices vary by manufacturer, these units store telemetric data including heart rate, rhythm and all cardioversion events for at least six months [2]. Retrieving the information recorded at the time of the injury or accident is a simple procedure and provides insight into the cause and result of the inciting event. We hypothesize that this resource has been underutilized in the routine care of the trauma patient and advocate for more diligent attention to defibrillators and pacemakers in this subset of the aging population.

Materials and Methods

To better understand the routine practice habits of trauma surgeons regarding implanted PMs and ICDs, we surveyed 1,578 members of the Eastern Association for the Surgery of Trauma (EAST) of whom 231 (14.6%) responded. A proposal was presented for an opinion research study to the leadership of EAST. After approval, a web based questionnaire comprised of four information and opinion questions was sent to all members. The survey provided a four-point Leichardt scale for responses. Results were calculated by per cent of responses to each question.

Results and Discussion

We found only 37/231 (16%) of surgeons surveyed always obtain memory interrogation of these devices, 94/231 (41.1%) responded that they frequently do so. Conversely 81/231 (35.1%) of respondents stated that they rarely obtain this information and 19/231 (7.8%) never check the device in an injured cardiac patient. Additionally, we found a high degree of misconception regarding

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how long data is stored on these devices, 50% of respondents believing that information is either not stored at all, or only stored for 24 hours, while 42.2% believed it is stored for 7 days, and only 7.8% responding correctly that the information is stored for at least 6 months. Immediate interrogation of the implanted device is neither practical nor necessary and attention is rightly focused on stabilization of the patient and timely transport to the radiology suite, the intensive care unit or the operating room. Our data indicates that after the acute events are managed, presence of the implanted device is often overlooked. Even in a stable patient without specific cardiac symptoms it may not occur to the trauma team to interrogate the device. Finally, identification of the device and subsequent contact with the manufacturer representative is a process with which many trauma surgeons are unfamiliar. When the patient has been stabilized, device interrogation is a critical aspect of the total care of the injured cardiac patient. There are several ways surgeons can identify the type of device and the correct manufacturer's representative to retrieve telemetric data. The patient or family member should have an ID card with the device information. Alternatively, the device can be identified on chest radiograph. Implantable devices have a radio-opaque alphanumeric code that can be used to identify the device. A high quality chest X-ray should be obtained for identification purposes. The shape of the device and battery orientation can be used in order to identify the manufacturer so the specific device representative can be contacted to interrogate and retrieve stored telemetric information.

Interrogation is a rapid and noninvasive procedure involving placing a wand or telephone receiver over the device. Information obtained includes the model, type, date of implant, battery status, lead integrity, programmed mode, heart rate range, as well as a log of arrhythmias, dates and times of ICD discharges, and energy delivered [3]. Other issues can be addressed at this time by the technicians to improve cardiac function that includes changing rate and sensitivity settings. Elderly patients with poor cardiac function who are totally pacemaker dependent may benefit from a higher heart rate for recovery that healthy patients often generate naturally. It is a simple matter to adjust pacing parameters in the device at the time of interrogation to increase heart rate and thus improve cardiac output and oxygen delivery. More serious device issues that are identified may require further interventions, and clearly any cardiac event or dysrhythmia that may have precipitated the traumatic event can be identified and treated by a cardiologist or electro physiologist.

Patients with implantable devices are high risk for arrhythmias and cardiac events that may precipitate a traumatic event such as motor vehicle collision. Conversely, trauma can also lead to device malfunction or damage [4]. In either case, interrogation of the device is necessary for total management of these issues. Patients who have ICDs placed for treatment of refractory arrhythmias or a history of sudden cardiac death remain at risk for ventricular tachyarrhythmias that can be symptomatic prior to termination of the arrhythmia by device discharge. The onset of ventricular tachycardia or ventricular fibrillation causes dizziness, palpitations, and potentially syncope. A retrospective review of 421 patients with an ICD found that 14.7% experienced a syncopal event related to recurrent ventricular arrhythmias [5]. This has implications for operating a motor vehicle or heavy machinery. There is also an increased risk of motor vehicle collision for patients with a pacemaker or ICD. A survey of physicians from 1980-1992 found that 10.5% of ICD discharges while driving resulted in collisions. The discovery of a precipitating arrhythmia that may have lead to a motor vehicle collision [6]. Fall or other traumatic event has implications beyond the traumatic injury itself.

Complete care of this subset of patients may require further cardiac interventions or medication adjustments for recurrent arrhythmias, myocardial infarction, or other cardiac event. Device interventions may be necessary, such as battery replacement, replacement of fractured or displaced leads leading to failure to capture and/or inappropriate pacing, and rarely blunt trauma to the device itself that may damage the generator. Lead dislodgment and subsequent pacemaker failure following even low velocity motor vehicle collisions that required lead replacement has been reported [7]. Careful inspection of the device pocket is necessary during the secondary or tertiary survey to rule out hematoma or local injury.

There are other important issues related to implantable cardiac devices that may concern patient care by the trauma surgeon including central line placement, as contact of the metal guide wire with the pacer wire within the central circulation can cause inappropriate discharge of an ICD or damage to the electronic conduction of the lead. Infective endocarditis is also a concern in patients with central line associated bacteremia in the presence of a pacemaker or ICD. The presence of these devices may preclude use of MRI for diagnostic imaging and therefore manufacturer and model information should be ascertained in order to assess for MRI compatibility. Many devices now in use are RMN-compatible and there for safe for all radiographic studies.

Trauma patients who have an ICD or PM in place and require emergency surgery also require special attention to prevent inadvertent reprograming or discharge of the device due to cautery use [8]. In emergent clinical situations the type and manufacturer of the device is rarely known so universal precautions should be utilized. Ground pads should never be placed in proximity to the pocket or in a way that electrical current can pass across the device. There are many situations where either a pacemaker needs to be made asynchronous or a defibrillator needs to have its tachycardia detection disabled. These tasks can be accomplished either by placing a magnet over the pocket containing the device or reprogramming the unit. Rarely will time allow reprogramming the ICD to the desired mode but this can be considered in more elective scenarios [9]. However, re-interrogation with possible reprogramming of the device after use of electrocautery is required to ensure that the device is reset and functioning correctly.

Conclusion

PMs and ICDs are life saving devices and telemetric data stored in them serve the trauma team as windows into the past cardiac status of this subset of injured patients. As such, patients with an implanted cardiac device have never had an "unwitnessed" event. Patients with a history of compromised cardiac function are among the sickest patients we care for, as they often do not have the physiologic reserve to deal with the burden of even minor injuries. Routine interrogation in the trauma setting is a highly valuable but underutilized tool and critical for the comprehensive care of the injured cardiac patient. We advocate for more aggressive utilization of this resource.

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