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The Crash Course: A Shocking Introduction to Defibrillation

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VIDEO ONE

The recent global pandemic necessitated a remodeling of the medical education system, with many curricula converting to primarily virtual platforms. Often omitted in this transformation to remote learning were rapid-response and code training live instructional opportunities, a critical absence given that learners' confidence with and retention of these critical educational materials is historically poor (1). To address these gaps, these videos provide a remote, asynchronous curriculum for rapid-response and code scenario management accessible by medical professionals at all levels at will. This curriculum may benefit learners as stand-alone modules or as an adjunct to current teaching methods. This series begins with an introduction to defibrillation (Video 1).

Defibrillation is the delivery of a high-energy shock to the myocardium to terminate life-threatening arrhythmias (2). The energy current required to electrically reset the heart is determined by the universal equation: $V = IR$ or $I = V/R$.

Most defibrillators measure energy in Joules. Hence, the selected voltage V generates a certain amount of current I. At a given V, the current I ultimately delivered to the patient varies depending on the impedance, R, of the system (3). Impedance across the chest for cardiac defibrillation may be higher in patients with higher body weight, chest width, and chest wall thickness and in conditions such as advanced chronic obstructive pulmonary disease (4). Poor defibrillator pad contact to the skin surface and small pad size also increase impedance and

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The videos can be viewed in the online version of this article.

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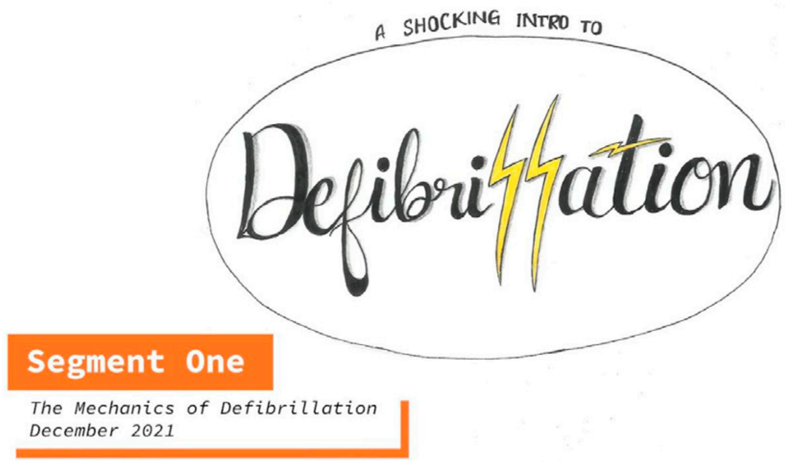

Video 1. An introduction to defibrillation, indications for defibrillation, defibrillator types, and overcoming the resistance of the chest wall.

therefore decrease delivered current to the myocardium (5). This curriculum encourages learners to be mindful of factors that increase resistance, *R*, before selecting ample energy, *V*, to overcome impedance and maximize the chance of successful defibrillation and demonstrates real-world examples of successful and unsuccessful defibrillation energy.

Biphasic defibrillators are preferred by the American Heart Association (6). Indications for defibrillation include deadly ventricular arrhythmias, namely pulseless monomorphic or polymorphic ventricular tachycardia and ventricular fibrillation, which are demonstrated with real-world examples.

The use of the "synchronize" button before defibrillating monomorphic ventricular tachycardia may result in better efficacy in terminating the arrhythmia without prolonging the time to successful defibrillation, although the amount of evidence is small (7). Delivery of an unsynchronized shock for monomorphic ventricular tachycardia may be proarrhythmic, inducing ventricular fibrillation and thus increasing time in cardiac arrest (7).

In conclusion, learners at all levels may benefit from this concise, evidence-based introduction to the mechanics of defibrillation.

VIDEO TWO

The second part of this concise, evidence-based introduction to defibrillation covers pad placement, misinformation, and troubleshooting (Video 2). Real-world examples are then used to demonstrate both the controls on a standard biphasic defibrillator and a well-performed defibrillation as a part of a team-based resuscitation effort.

Most defibrillator pads used in today's hospitals are the self-adhesive type. In clinical trials, self-adhesive pads have better outcomes than paddles, as they optimize contact, thus reducing impedance, during shock delivery (8). Current clinical evidence does not clarify ideal pad positioning (9), and the latest American Heart Association guidelines list three possible placements: anterior-lateral, anterior-posterior, and apical-posterior (10). We offer learners at all levels a review of the relevant physics and suggest that pad positioning be chosen on an individualized basis to create the best time-sensitive "heart sandwich." This approach invokes an understanding of the flow of energy and ensures that most of the delivered current passes through the myocardium during shock delivery.

Video 2. Defibrillator pad placement, shocking misinformation, and troubleshooting, followed by real-world examples of use of defibrillator controls and team-based resuscitation integration.

Misinformation is common in medical practice (11), and defibrillation is a high-stakes event that is associated with many myths. We review recommendations regarding body jewelry, tattoos, patients with body hair, and those with implanted cardiac devices (6).

Code and rapid-response scenarios are stressful events. Medical professionals rapidly assume a leadership role while implementing an algorithmic approach to high-stakes patient care. It is the role of the code-team leader to maintain good communication with the resuscitation team, to delineate roles, and to clearly specify subsequent steps.

Inefficient communication can result in delayed resuscitation, as well as provider harm (12, 13). Healthcare professionals may be accidentally injured during a defibrillation attempt because of poor communication or knowledge or both. Hence, the role of the code leader is not just to guide resuscitation of the patient but also to protect members of the code team. In this educational video, we aim to characterize good communication with example language to help leaders bring order, calm, and trust to tense and dynamic situations.

The series concludes with a review of high-yield learning points.

Author disclosures are available with the text of this article at www.atsjournals.org.

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